



# Acrylamide and Furan in Retail Products – Combined Results 2020- 2021

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## 1. Acrylamide and Furan in Retail Products

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### Report of Analysis of Retail Products for Acrylamide and Furan for Food Standards Agency Fera Science Ltd.

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### 3. Glossary

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- 2,3DMF 2,3-dimethylfuran
- 2,5DMF 2,5-dimethylfuran
- 2MF 2-methylfuran
- 3MF 3-methylfuran
- ALARA As low as reasonably achievable
- BML Benchmark Level
- EFSA European Food Safety Authority
- EURL European Reference Laboratory
- Fapas® Food Analysis Performance Assessment Scheme (Proficiency Testing)
- FSA Food Standards Agency
- GC-MS Gas Chromatography Mass Spectrometry
- HS-GC-MS Headspace Gas Chromatography Mass Spectrometry
- IS Internal Standard
- LC-MS/MS Liquid Chromatography Tandem Mass Spectrometry
- LOQ limit of quantification
- MOE Margin of Exposure
- NRL National Reference Laboratory
- UKAS United Kingdom Accreditation Service

## 4. Executive Summary

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This study was commissioned as a result of a call from the Food Standards Agency to produce data on acrylamide, furan and alkyl furans in food to gain information on the occurrence of these contaminants in UK foods to inform future regulatory decisions. The study was carried out over two consecutive years to allow trending of data year on year. This report summarises the findings of the study.

The survey has been successfully completed over two years. One hundred and sixty two samples were purchased and analysed in Year 1 and one hundred and thirty samples were purchased in Year 2 to agreed sampling plans. In Year 1, one hundred and thirty samples were analysed for acrylamide and sixty for furans. In Year 2, seventy eight samples were analysed for acrylamide, twelve were analysed for furans, and forty were analysed for both. Analysis for acrylamide was carried out using a method that is accredited to ISO 17025.

A method was developed and validated for 2-methylfuran, 3-methylfuran, 2,5-dimethylfuran, 2-ethylfuran, butylfuran and propylfuran and 2-pentylfuran in foods. Target limits of quantification (LOQ) not higher than 5 µg/kg for foods and 20 µg/kg for coffee, were achieved for most analytes. The method has been accredited to ISO 17025 using Flexible Scope.

As furan and its methyl analogues such as 2-methyl furan and 3-methyl furan are highly volatile, some furan samples were prepared according to the manufacturers' instructions prior to analysis to be tested 'as consumed'.

This survey was intended to be exploratory and to gather data. As such, it should be borne in mind that many of the products included in this survey do not fall within the description categories in Retained Regulation (EU) 2017/2158 <sup>(1)</sup> and therefore BenchMark Levels (BMLs) do not apply to many of the products sampled.

The highest levels of acrylamide were observed in vegetable crisps, (carrot and parsnip components contained the highest levels), an extruded veggie straw product, coffee, a sample of dried apricots and a sample of olives in brine. These findings were the same in both sampling periods, the concentrations of acrylamide found in the products in both years were very similar. Coffee drinks prepared from the ground or instant coffee contained low levels of acrylamide. When the level of acrylamide of the dry instant or ground coffee used to prepare the drinks was calculated using the level measured in the

drinks, good agreement was found with the results of the original acrylamide analysis of the dry products.

There are no guidance levels or action levels for furans. The majority of samples contained low levels of furans. The highest levels were observed in coffee, both ground and instant. When these were used to prepare beverages the resulting furan levels were much reduced, typically around 1% of the levels in the dry coffee. For foods such as baby ready meals, and ready to eat soups, low levels of furan were found. Pentylfuran was found in some products, the highest levels were found in vegetable crisps. These results should be considered indicative due to analytical issues. Further work to improve the analysis of pentylfuran is recommended.

This survey provides exploratory data and gives a snapshot of the levels of processing contaminants in a range of products purchased in 2020 and 2021. The results from Year 1 and 2 have been combined in this final report and compared across 2 years. Very few differences were observed in levels of acrylamide and furans in the products tested between the two years, and there was consistency in levels found in similar products between the two years.

## 5. Introduction

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### 5.1 Background to the study

Acrylamide, furan and alkyl furans (e.g. 2-methyl furan and 3-methyl furan) are organic chemicals produced when food is heated to high temperatures during cooking and food processing. EFSA published risk assessments of acrylamide and furan in food in 2015 and 2017 respectively. The Food Standards Agency (FSA) has concluded that exposure to these process contaminants should be as low as reasonably achievable (ALARA) and has previously funded monitoring of acrylamide and furans to gather occurrence data in UK retail foods. This study will build on the previous studies by providing analytical data on the occurrence of acrylamide and furan, 2-methylfuran (2MF) and 3-methylfuran (3MF), as well as other alkylfurans, namely 2,5-dimethylfuran (2,5DMF), 2,3-dimethylfuran (2,3DMF), 2-ethylfuran, 2-butylfuran, 2-propylfuran and 2-pentylfuran, in selected foodstuffs.

Retained European Commission Regulation (EU) 2017/2158 <sup>(1)</sup>, established mitigation measures and 'benchmark levels' (BML) for the reduction of the presence of acrylamide in food. Member States and food business operators are required to monitor acrylamide levels in the foodstuffs listed in Annex IV of the regulation. In addition, Commission Recommendation (EU) 2019/1888 <sup>(2)</sup>, published in November 2019, suggested a non-exhaustive list of products for monitoring. Commission Recommendation 2007/196/EC <sup>(3)</sup> sets out a recommendation for the monitoring of the presence of furan, 2-methylfuran and 3-methylfuran in foodstuffs. At the end of the transition period applicable EU legislation as it stood on 31<sup>st</sup> December 2020 was converted into domestic law, therefore the 'benchmark levels' are applicable in Great Britain and Northern Ireland.

### 5.2 Acrylamide

Acrylamide is a natural chemical that is formed when starchy foods such as bread and potatoes are cooked for long periods at high temperature. When these foods are cooked (fried, baked, roasted, toasted or grilled) to above 120°C acrylamide can be formed.

Acrylamide is formed mainly from sugars and the amino acid asparagine, which are both found naturally in foods, as a result the chemical process, the Maillard Reaction.

Acrylamide does not usually occur in foods that have been cooked using lower

temperatures such as boiling, but it has been found in a wide range of processed and home-cooked foods including potato crisps and chips (fries), bread, crispbreads and coffee.

### **5.3 Furan and alkyl furans**

Furan and furan analogues are formed naturally in foods during roasting or heating. Furans are produced from several precursors including ascorbic acid, amino acids, carbohydrates, unsaturated fatty acid and carotenoids. They can be found in a variety of foods including coffee, and canned or jarred foods. An EFSA Scientific Opinion published in 2017 <sup>(4)</sup> reviewed occurrence data for furan but reported no occurrence data was available for methyl furans (2-methylfuran, 3-methylfuran and 2,5-dimethylfuran), therefore no assessment of exposure to these compounds could be made. The highest exposures of furan were estimated to occur in the youngest population group, i.e. infants. Furan was assessed as being potentially nephrotoxic, hepatotoxic and due to some indications of genotoxicity the CONTAM Panel decided it was not appropriate to establish a tolerable daily intake, instead they used a Margin of Exposure approach. The calculated MOE was smaller than 10,000 which would indicate a health concern. Due to the fact that methyl furans occur together and the potential for chronic dietary exposure to these compounds EFSA stated that methylfurans may add significantly to the overall exposure and therefore increase the cause for concern for hepatotoxicity. The CONTAM Panel recommended that additional data on the occurrence of methylfurans in food as well as changes in concentration of furan and methylfurans during the different steps of coffee preparation should be produced.

### **5.4 Aims and Objectives of the Study**

This study was commissioned as a result of a specific call from the Food Standards Agency to produce data on acrylamide, furan and alkyl furans in food in response to the European Commission monitoring recommendations and to gain information on the occurrence of these contaminants in UK foods.

A sampling plan of target foodstuffs was agreed with the FSA, with sampling to be conducted on each of two years. Analysis over two years was intended to allow trending of data year on year. Samples for acrylamide analysis were selected to be exploratory and included foods from the Annex in Commission Recommendation (EU) 2019/1888 <sup>(2)</sup>, and the products listed in Retained Commission Regulation (EU) 2017/2158 <sup>(1)</sup>.



Analysis for acrylamide was carried out using a method that fully meets the requirements in Annex III of Retained Commission Regulation (EU) 2017/2158 <sup>(1)</sup> and is accredited to ISO 17025.

For 2-methylfuran, 3-methylfuran, 2,5-dimethylfuran, 2-ethylfuran and 2-pentylfuran in foods, a method was validated, with a target limit of quantification (LOQ) not higher than 5 µg/kg for foods and 20 µg/kg for coffee, and accredited to ISO 17025 (UKAS) based on guidelines from Commission Recommendations 2007/331/EC <sup>(5)</sup> and 2007/196/EC <sup>(3)</sup>. Additional compounds 2,3-dimethylfuran, 2-propylfuran and 2-butylfuran were included in 2021.

As furan and its methyl analogues such as 2-methylfuran and 3-methylfuran are highly volatile, some furan samples were prepared according to the manufacturers' instructions prior to analysis and tested as received and as consumed to allow for any losses during preparation.

The study was carried out over two years, this report summarises the results of both years. This survey was intended to be exploratory and to gather data. It should be borne in mind that many of the products included in this survey do not fall within the description categories in Retained Regulation (EU) 2017/2158 <sup>(1)</sup> and therefore BMLs do not apply to many of the products sampled.

## 6. Methodology

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### 6.1 Samples

Sample purchase and collection was subcontracted to HallMark Veterinary & Compliance Services. Draft sampling plans were provided by the Food Standards Agency, these were used to plan purchase and collection of samples. The detailed sampling plan was agreed in advance each year by the Food Standards Agency before sampling started. Samples were collected from a number of regions throughout the UK. In Year 1 samples were collected over a 6 week period in July and August 2020 and in Year 2 over an 8 week period in July and August 2021. Samples were purchased from a broad range of retailers and included a variety of brands. Full details of samples are given in the individual reports from Year 1 and Year 2 of this survey<sup>(6,7)</sup>. A summary of the type and number of samples purchased is given in Table 1. Products were broadly categorised according to the food descriptions in Retained Commission Regulation (EU) 2017/2158<sup>(1)</sup>. In addition, Commission Recommendation (EU) 2019/1888<sup>(2)</sup> sets out a list of food types that should be monitored for the presence of acrylamide and samples of these products were also included. The sampling scheme for Year 2 was designed, as far as possible, to replicate the sampling from Year 1 to allow comparisons to be made year on year.

### 6.2 Sample preparation

Samples were prepared and stored according to the Food Standards Agency “Guidelines for undertaking surveys”<sup>(8)</sup>.

For samples requiring acrylamide analysis only, the whole sample was homogenised and split into portions for analysis and storage. Potato products such as croquettes and potato based meals and other vegetable chips such as onion rings and sweet potato fries samples were cooked and analysed as consumed in Year 1 and as received in Year 2. For samples that required both furan and acrylamide analysis, the samples were split equally. A homogenised sample was prepared from one portion for acrylamide analysis. Samples for furan were kept intact and opened and mixed in cooled conditions before being placed immediately in cooled headspace vials for analysis. Where appropriate, samples for furan analysis were also analysed as purchased and as consumed. For example, some foods for young children and infants were sampled and analysed immediately from the container after opening and after heating according to the manufacturers’ instructions.

Coffee was analysed as purchased and as consumed. Coffee brews were prepared following packet instructions, the exact sample weight and volume of hot water were recorded during preparation.

### **6.3 Analysis for acrylamide**

Analysis for acrylamide was carried out using an ISO 17025 accredited method. The method is based on the CEN/TS 17083:2017 Foodstuffs - Determination of acrylamide in food and coffee by gas chromatography-mass spectrometry (GC-MS) <sup>(9)</sup>. Quality control samples including procedural blanks, in-house reference samples and spiked samples were included in each batch.

### **6.4 Analysis for Furan and alkyl furans**

A method for furan, 2-methyl furan and 3-methyl furan was already in place in the laboratory. The method was expanded to include furan, 2-methyl furan, 3-methyl furan, 2,5-dimethylfuran, 2,3-dimethylfuran, 2-ethylfuran, 2-pentylfuran, 2-butylfuran and 2-propylfuran. Method development to investigate the most appropriate conditions for different matrices was carried out. Satisfactory validation was obtained for all analytes except 2-pentylfuran, 2-butylfuran and 2-propylfuran in some matrices, and where reported these results are for information and are not accredited.

Isotopically labelled standards Furan-d4, 2-methyl-furan-D6, 3-methyl-furan-D3, 2-ethylfuran-D5, 2,5-dimethylfuran-D6 and 2-pentylfuran-D11 were used in the analysis, these were not all available in Year 1 and therefore all analytes are not reported in Year 1. Quality control samples including procedural blanks, in-house reference samples and spiked samples were included in each batch. Results are UKAS accredited (ISO 17025), following accreditation of the method via Flexible Scope.

## 7. Results and Discussion

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### 7.1 Sampling

In Year 1, 162 samples were collected from a number of regions throughout the UK over a 6 week period in July and August 2020. In Year 2, 130 samples were collected during the 8 week sample collection period in July and August 2021. There were no significant deviations in terms of the samples per retailer and areas, some minor deviations were due to occasional unavailability of the sample or insufficient quantity available at the selected supermarkets. When this was the case, initially pre-assigned retailers were swapped for samples from small retailers and wholesalers. All samples were transferred to the laboratory under appropriate conditions, for example, chilled or frozen, samples were couriered using cold boxes and were immediately placed in fridges or freezer on receipt. Samples were logged in using a Laboratory Information Management System (LIMS) and were each assigned a unique number.

### 7.2 Sample preparation

Samples were prepared and stored according to the Food Standards Agency “Guidelines for undertaking surveys”<sup>(8)</sup>. Samples for acrylamide analysis only were homogenised using the most suitable equipment, and if necessary, using cryomilling. Stones and brine were removed from products in jars. In Year 1 only, potato products and other vegetable chips such as onion rings and sweet potato fries were cooked before analysis following the instructions on the packaging. The cooked samples were homogenised separately and split into aliquots for analysis and storage.

For samples that required both furan and acrylamide analysis, the samples were split equally. A homogenised sample was prepared from one portion for acrylamide analysis. Samples for furan were kept intact and opened and mixed in cooled conditions before being placed immediately in cooled headspace vials for analysis. Where appropriate, samples for furan analysis were also analysed as purchased and as consumed.

Coffee was analysed as purchased and as consumed. Coffee brews were prepared following packet instructions, the exact sample weight and volume of hot water were recorded during preparation.

Baby foods were prepared according to the manufacturers for instructions, using water to reconstitute dried products where required. For vegetable crisps and chips, the packets

were opened, and the samples sorted into the individual vegetable varieties. These were homogenised and analysed separately.

All sample homogenisation methods have been previously shown to produce an acceptably homogenous sample as they are used routinely for the preparation of proficiency test samples.

### **7.3 Acrylamide analysis by GC-MS**

The method is based on CEN TS 17083:2017 Foodstuffs – Determination of acrylamide in food and coffee by Gas Chromatography-Mass Spectrometry (GC-MS) <sup>(9)</sup> and is accredited to ISO 17025.

For analysis the test portion was extracted with hot water, isotopically labelled acrylamide was added as an internal standard. High fat samples were defatted with hexane, cleared with Carrez solution and centrifuged.

Sample extracts were brominated and extracted with ethyl acetate. Following removal of the ethyl acetate and evaporation, triethylamine is added to partially debrominate, after which the sample extracts were injected onto a GC/MS system for quantification using selected ion monitoring.

Quality control samples including procedural blanks, in-house reference samples and spiked samples were included in each batch.

### **7.4 Furan and alkyl furan analysis by Headspace GC-MS**

A headspace GC-MS method for furan, 2-methyl furan and 3-methyl furan was already in place in the laboratory. The method was expanded to include furan, 2-methyl furan, 3-methyl furan, 2,5-dimethylfuran, 2-ethylfuran, 2-pentylfuran, 2-butylfuran and 2-propylfuran. The method used isotopically labelled internal standards where available. Internal standards used were: Furan-d4, 2-methyl-furan-D6, 3-methyl-furan-D3, 2-ethylfuran-D5, 2,5-dimethylfuran-D6, and 2-pentylfuran-D11. 2-ethylfuran-D5 was used as an internal standard for propyl and butylfuran, and 2,5-dimethylfuran-D6 was used as internal standard for 2,3-dimethylfuran. Satisfactory validation was obtained for all analytes except for some matrices for 2-pentylfuran, 2-butylfuran and 2-propylfuran, and where reported these results are for information only and are not accredited.

### **7.5 Analytical quality assurance**

All analyses were performed by trained staff in a UKAS accredited laboratory. All test methods were validated in house. Analysis for acrylamide was already accredited to ISO17025. Analysis for furans was in-house validated during this study and results are accredited to ISO17025 by Flexible Scope.

Each batch of samples included procedural blanks, in-house reference samples and / or spiked samples. Isotopically labelled standards were used to control the methods where they were available.

The laboratory also participates in the Fapas® proficiency testing scheme for acrylamide and furan (Series 30). Fera participated in five rounds in Year 1 and three during Year 2 of the survey for acrylamide in a variety of food products (all included in this survey). All results were satisfactory. Fera participated in one round for furans in Year 1. There were no rounds for furans during the second year reporting period, therefore a previous Fapas® test material and a reference standard supplied by LGC were used to assess method performance. Results for acrylamide PT performance are given in Table 33. Batch QC data for acrylamide analyses are given in Table 35 and for furans in Table 37 and Table 38. Results for furan accuracy and precision checks are given in Table 39 and Table 40.

For samples found to contain higher concentration residues, or where residues were close to or above relevant BMLs, the analysis was repeated in duplicate to confirm the initial finding. All confirmed results are the mean of at least 3 determinations.

## 7.6 Acrylamide results

### 7.6.1 Bread samples

Twelve samples of 'Bread' samples were analysed for acrylamide in Year 1. These included five pumpnickel, ciabatta with olives and onion bread (speciality breads), four samples of rolls and three samples of pitta bread. Ten samples were below the LOQ of 30 µg/kg acrylamide. The two samples that contained acrylamide above the LOQ were a pumpkin sourdough bread that contained 78 µg/kg and a ciabatta with olives that contained 89 µg/kg. The results are given in Table 2.

In Year 2, 12 samples of bread were analysed but sampling focussed on rye bread, rye and buckwheat boule, breads that contained olive (ciabatta and bloomer) and speciality flat bread and bloomers. Eight samples were <30 µg/kg acrylamide. Two samples of bloomer with olives contained acrylamide above the LOQ, these were a Trio of olive bloomer that contained 57 µg/kg, and a bloomer with Kalamata olives that contained 56 µg/kg. A sample of mixed olive rolls contained 82 µg/kg and ciabatta with olives contained 45 µg/kg. The results are given in Table 3.

Only two products were sampled in both years, a rye bread and a ciabatta with olives, their results are compared in Table 4. The rye bread contained <30 µg/kg in both years, and the ciabatta with olives contained 89 µg/kg in Year 1 and 45 µg/kg in Year 2.

A BML of 50 µg/kg is given for 'soft bread – wheat-based bread' in Retained Commission Regulation (EU) 2017/2158 <sup>(1)</sup>. All of the products with acrylamide concentrations above this level listed wheat as their main ingredient, however it is not clear if they meet the definition of 'soft bread'. It is possible that the inclusion of olives as an ingredient contributed to the acrylamide content, as acrylamide has been reported in olives <sup>(10)</sup>. However, this cannot be confirmed as the samples were homogenised and analysed as a whole product.

### 7.6.2 Breakfast Cereals (excluding porridge)

Five samples, two honey roasted muesli and three other traditional breakfast cereals, were analysed in both years. The same brands were analysed to allow a comparison and results are given in Table 5. Acrylamide levels found ranged from 49 µg/kg in a sample of cornflakes to 278 µg/kg in a wheat biscuit in Year 1 and from 55 µg/kg in a cornflakes sample to 286 µg/kg in a wheat biscuit in Year 2. Overall the results of the products were

very similar at both sampling points. The largest difference was seen for the multigrain hoops, a level of 132 µg/kg was found in Year 1 versus a level of 194 µg/kg in Year 2. Benchmark levels range from 100 µg/kg for maize, oat, spelt, barley and rice based products to 300 µg/kg for bran products, whole grain cereals and wheat and rye based products. All samples were below their respective BML.

### **7.6.3 Fine Bakery Wares (excluding cakes and pastry)**

Twenty-three and sixteen samples of fine bakery wares were analysed for acrylamide in Year 1 and 2 respectively.

On the whole the results from both years were similar, they are presented together in Table 6. The samples from Year 1 and 2 were not always the same brand but the products analysed were similar enough to allow comparisons to be made.

Five croissants were analysed in Year 1, four were below the LOQ (<30 µg/kg), while one was just above. Both croissant samples in Year 2 did not contain acrylamide above the LOQ (<30 µg/kg).

Acrylamide was not found above the LOQ in any of the doughnut samples.

The three churros samples in Year 1 contained acrylamide levels ranging from <30 µg/kg to 71 µg/kg, while the churros sample in Year 2 did not contain acrylamide (<30 µg/kg).

For the two yum yums samples (Year 2), one was below the LOQ, while the other contained 118 µg/kg, low levels of acrylamide were detected in the two éclair samples, and no acrylamide was found above the LOQ in the Danish pastry sample.

Five samples of pancakes were analysed in Year 1, one contained acrylamide at 73 µg/kg while the others were below the LOQ. The highest level of acrylamide found in the bakery products was 196 µg/kg in buttermilk pancakes analysed in Year 2.

The other five products were samples of shortbread, cream crackers, rye cracker bread, oat cakes and wholegrain crackers. Of these, the shortbread did not contain acrylamide above the LOQ (<30 µg/kg) in both years, the other four products contained levels from 42 to 236 µg/kg in Year 1 and 117 to 326 µg/kg in Year 2. The highest level was found in the rye crispbread sample. Products contained similar levels in both years, e.g. rye crispbread contained 218 µg/kg in Year 1 and 238 µg/kg in Year 2.

There are BMLs for biscuits (350 µg/kg), crackers (400 µg/kg) and crispbread (350 µg/kg), none of the samples that fit in these categories exceeded the BMLs.

### **7.6.4 Coffee**



In Year 1 ten samples of coffee, four instant and six ground and in Year 2 five samples of coffee, two instant and three ground were analysed for acrylamide, both as purchased and 'as consumed'. Acrylamide levels in the Year 1 instant coffee – 'as purchased' ranged from 646 to 884 µg/kg, the highest level was found in a sample of decaff coffee. This result is above the BML of 850 µg/kg, but is not beyond reasonable doubt when measurement uncertainty is taken into account.

Acrylamide levels in the Year 2 instant coffee – 'as bought' were 443 and 687 µg/kg, again the highest level was found in a decaff coffee, the same brand as Year 1.

The acrylamide levels in the drinks prepared from these samples, the 'as consumed' samples, ranged from 4.7 to 7.7 µg/L for the Year 1 samples. The acrylamide levels in the drinks prepared from the Year 2 samples, were 4.7 and 5.3 µg/L. These results calculated to levels showing a high level of agreement with those found in the dry products.

For the Year 1 ground coffee the acrylamide levels ranged from 163 to 356 µg/kg, and the corresponding 'as consumed' samples ranged from 9.3 to 11.6 µg/L, corresponding to calculated levels of 158 to 299 µg/kg in the dry coffee.

For the Year 2 ground coffee the acrylamide levels ranged from 121 to 305 µg/kg, the levels in the corresponding 'as consumed' samples ranged from 4.8 to 13.9 µg/L. The BML for roast coffee is 400 µg/kg. None of the samples exceeded this, results across the two years were very similar, and are presented in Table 7 and Table 8.

#### **7.6.5 Coffee substitutes - Products not based on chicory or cereals**

Five samples of coffee substitute were analysed for acrylamide in Year 1, results are given in Table 9. One sample contained acrylamide above the reporting limit at a level of 57 µg/kg (as purchased). There are BMLs for coffee substitutes in Retained Regulation (EU) 2017/2158, but these apply for products made from chicory or cereals. There are no applicable BMLs for the products analysed in this study.

The samples were also prepared following the packaging instructions and analysed 'as consumed'. Two brewed samples contained <0.3 µg/L the other three samples contained 0.6 µg/L to 2.1 µg/L. The sample that contained 2.1 µg/L acrylamide in the beverage was the only coffee substitute that contained acrylamide above the reporting limit in the dry product.

#### **7.6.6 Foods intended for infants and young children – savoury meals**

Ten savoury ready meals intended for infants and young children (based on cereals) were analysed in Year 2. These were analysed as purchased, nine contained acrylamide below

the LOQ (<30 µg/kg) and one sample of chicken and sweet potato curry contained 36 µg/kg Table 10. No products in this category analysed for acrylamide in Year 1.

#### **7.6.7 Foods intended for infants and young children – rice, rusks, & porridge**

In Year 2 ten samples of cereal based foods intended for infants and young children including baby rice, porridge, rusks and bay biscuits/biscotti were analysed for acrylamide. These were analysed as purchased, and results are given in Table 11. There were no products in this category analysed for acrylamide in Year 1.

Seven products including rusks, muesli, baby rice, porridge and teething biscuits contained acrylamide below the LOQ.

A sample of vanilla and banana baby biscuit contained 232 µg/kg acrylamide, a sample of apple biscotti contained 259 µg/kg and a soft banana biscotti contained 276 µg/kg. All results are the mean of three measurements. The BML for Biscuits and rusks for infants and young children is 150 µg/kg.

#### **7.6.8 Other products based on cereals and potatoes – potato products**

In Year 1 ten potato products e.g. rosti, croquettes, were analysed. These products were cooked following the instructions on the packet. The levels found ranged from <30 µg/kg in potato croquettes to 1097 µg/kg in a frozen jacket potato heated in the oven. Five potato based ready meals (e.g. potato and cheese, casserole, potato and meat) were also analysed. Potato Dauphinoise and the sausage and mash meal both contained <30 µg/kg acrylamide. The other samples contained levels from 34 µg/kg to 218 µg/kg, which was found in a sample of crispy potato slices (results after cooking).

In Year 2 eight potato products were analysed, all products were analysed as sold. There were five potato products such as rosti and croquettes, and three potato based ready meals. All results from Year 1 and 2 are given in Table 12 and Table 13. The lowest level, (<30 µg/kg) was found in mini roasties. The levels found in the four other products ranged from 51 µg/kg for cheese croquettes to 94 µg/kg in potato waffles.

The three potato based ready meals (for example, potato and cheese, potato and meat) were also analysed as purchased. Potato Dauphinoise and the cottage pie both contained <30 µg/kg acrylamide. A sample of cheese & bacon potato skins contained 106 µg/kg.

Retained Regulation (EU) 2017/2158 contains a BML of 500 µg/kg for French Fries (ready to eat), i.e. as sold direct to consumers from takeaways. None of the products analysed would be categorised as ready to eat and so the BML does not apply. It is most likely that any possible future regulatory levels for this type of products would be set for products as

sold, rather than as consumed which is why products were analysed as sold in Year 2. All of the potato samples in Year 2 were below 500 µg/kg.

#### **7.6.9 Other products based on cereals and potatoes – cereal snacks.**

In Year 1 three samples of Mexica tortillas (wraps) and ten samples of cereal snacks (e.g. Rice Cakes, Rice Crackers, Maize Crackers etc.) were analysed.

The three tortilla samples did not contain acrylamide above the reporting limit of 30 µg/kg. There is no BML for this type of product.

Of the other ten samples, four were rice cakes, and one was a rice and corn cake. Levels in these samples ranged from 90 to 222 µg/kg. There were three rice cracker samples, two contained no acrylamide above the LOQ, and one contained 70 µg/kg. The two other samples were corn cakes that contained 215 µg/kg and corn thins (414 µg/kg).

In Year 2 five samples of cereal snacks (e.g. Rice Cakes & corn cakes, Rice cakes and Rice Crackers) were analysed (all results in Table 14).

There were three rice cakes, and one rice and corn cake. Levels ranged from 82 to 416 µg/kg. There was one rice cracker sample, it contained 94 µg/kg.

Where the same products were analysed in both years the results were similar. For salt and vinegar rice crackers the levels were 90 and 110 µg/kg in Year 1 and 2. The Marmite crackers contained 222 µg/kg in Year 1 and 308 µg/kg in Year 2 and the Thai Chilli crackers contained 70 µg/kg in Year 1 and 93.5 µg/kg in Year 2.

There are no BMLs for these products.

#### **7.6.10 Snacks intended for infants and young children**

Fifteen samples of snacks marketed for young children were included in both years of the study. These included a selection of products such as rice cakes, oat bars, and extruded vegetable snacks. There is a BML of 150 µg/kg acrylamide for biscuits and rusks for infants and young children, the definition of these products is as defined in Retained Regulation (EU) 609/2013<sup>(11)</sup>. Products such as rice cakes or oat bars and would fit the definition from Retained Regulation (EU) No 609/2013 of 'processed cereal-based food - rusks and biscuits which are to be used either directly or, after pulverisation, with the addition of water, milk or other suitable liquids'. The other products included in the survey, for example veggie straws, chickpea or carrot puffs, while marketed for children, do not meet this definition and therefore the BMLs do not apply.

In Year 1, nine samples contained <30 µg/kg acrylamide, (Table 14), six samples of these fitted in the category that the BML would apply to. Three samples contained levels

between 41 and 96 µg/kg: chickpea and carrot puffs, apple & carrot rice crispy sticks and sweetcorn and carrot melty sticks. Two samples contained 144 µg/kg (banana puffcorn) and 182 µg/kg (carrot sticks). The highest level of 2439 µg/kg was found in a sample of veggie straws. This result is an average of five determinations as the analysis was repeated to confirm the unexpected result.

In Year 2, five samples contained <30 µg/kg acrylamide, (Table 15), these were all products that the BML would apply to. Four samples contained levels between 32 and 73 µg/kg: rice cakes, crunchy wheels, sweetcorn and carrot tubes and melty veggie sticks. Four samples contained from 103 µg/kg (carrot & lentil sticks) to 132 µg/kg (carrot puffs). The highest level of 1758 µg/kg was found in a sample of veggie straws which was the same product that had the highest level in Year 1. This result is an average of three determinations as the analysis was repeated to confirm the result.

Although the samples analysed in both years were not all the same, the results from Year 1 and 2 were similar, with the highest level was found in veggie straws, and products containing carrot contained levels at or above 100 µg/kg.

#### **7.6.11 Others – vegetable crisps and vegetable fries or chips**

In Year 1 five samples of vegetable crisps were included in the survey, seven samples were included in Year 2. Where the product was a mixture of vegetables, these were hand sorted into the individual types and these analysed separately.

In both years the samples of hummus chips contained no acrylamide (<30µg/kg). In Year 1 the sample of lentil bites contained 95 µg/kg and in Year 2 two samples of lentil chips contained 276 and 79 µg/kg respectively. A sample of mushroom crisps in Year 2 contained no acrylamide (<30µg/kg).

In both years there were three samples of mixtures of beetroot, carrot and parsnip (1 in Year 1 and 2 in Year 2), and beetroot, parsnip and sweet potato (2 in Year 1 and 1 in Year 2). In both years the lowest acrylamide concentrations were found in the parsnip component of one product (160 µg/kg and 78 µg/kg). This was not consistent between products as for another sample in Year 1 the parsnip portion contained 2293 µg/kg. The levels of acrylamide in the individual vegetable types were up to 2634 µg/kg in one portion of beetroot. In all three samples in Year 1, the beetroot component contained the highest amount of acrylamide.

In Year 2 the lowest acrylamide concentration was found in a parsnip component (78 µg/kg) of one sample, while the highest level was found in a parsnip component of another sample (2114 µg/kg). Levels in the other vegetables ranged from 490 µg/kg to 2464 µg/kg. Most results for the vegetable crisps were the average of 3 determinations as the analysis was repeated to confirm the initial finding. Vegetable crisps from both Years are given in Table 16.

In Year 1 five samples of vegetable chips or fries, and onion rings were analysed. As for the potato products, these were prepared according to manufacturers' instructions. The mixed root vegetable sample was split into the vegetable types before analysis.

Acrylamide levels ranged from <30 µg/kg for onion rings to 433 µg/kg in honey glazed parsnips.

In Year 2 five samples of vegetable chips or fries, and onion rings were analysed. These were analysed as purchased. The mixed root vegetable sample was split into the vegetable types before analysis. The results ranged from <30 µg/kg to 59 µg/kg in sweet potato chips. The honey glazed parsnips did not contain acrylamide (<30µg/kg). Results are collated in Table 17.

There are no BMLs applicable for any of these products.

#### **7.6.12 Others – miscellaneous products**

A small number of each of the following products listed in the Annex of Recommendation (EU) 2019/1888 were included in the both years of the survey: Roasted Nuts, Roasted Oilseeds, Dried Fruits, Roasted cocoa beans and derived products, Olives in brine, and Confectionary e.g. fudge, caramel, nougat.

Four samples of roasted nuts were analysed in each year. In Year 1 three contained no acrylamide above the LOQ and one sample contained 92 µg/kg. In Year 2 two contained no acrylamide above the LOQ, one contained 45 µg/kg and one contained 78 µg/kg. Six samples of roasted oil seeds were analysed over 2 years. Five roasted oilseeds did not contain acrylamide (all <30 µg/kg), while the other sample contained 70 µg/kg. Results are given in

Table 18.

Five dried fruit samples were analysed each year, in Year 1 three contained <30 µg/kg, the chopped dates contained 48 µg/kg and dried apricots contained 454 µg/kg (average of 3 analyses). These results were replicated in Year 2, five dried fruit samples were analysed, three contained <30 µg/kg, the sample of chopped dates contained 73 µg/kg and the sample of apricots contained 451 µg/kg (average of 3 analyses). Three samples of cocoa nibs were analysed each year. One sample in Year 1 did not contain acrylamide, while the other two contained 264 and 364 µg/kg respectively, both results the average of 3 determinations. The three samples of cocoa nibs from Year 2 contained from 69 to 274 µg/kg. Results are collated in Table 19.

None of confectionary samples analysed contained acrylamide. In both years two of the three olives samples did not contain acrylamide. In Year 1 an olive sample contained 281 µg/kg and in Year 2 an olive sample contained 490 µg/kg, both were black olives in brine. The samples that did not contain acrylamide were green olives. Results are presented in Table 20.

There are no BMLs set for any of these products.

## **7.7 Furan and alkyl furan results**

### **7.7.1 Potato crisps, snacks, crackers and other potato products from potato dough**

Five samples of potato products were analysed for furans in each year, results are in Table 21. Furan was detected in all samples in the range 11 µg/kg to 77 µg/kg in Year 1 and 9 µg/kg to 55 µg/kg in Year 2. The results were remarkably similar in both years, in both cases the lowest level was found in potato crisps and the highest in 'popped potato chips'. In both years, low concentrations of 2-methylfuran were found in four of the samples, and one sample contained a very low concentration of 3-methylfuran just above the LOQ of 5 µg/kg. Ethyl-furan was found in all samples in both years at levels from 20 to 147 µg/kg in Year 1 and 8 to 94 µg/kg in Year 2. In both years, the highest level was found in a sample of extruded 'french fries' which contained furan and 2-methyl furan but no 3-methylfuran. None of the samples contained 2,5-dimethylfuran, 2,3-dimethylfuran, butylfuran or propylfuran above the LOQ. Three samples in Year 2 were found to contain pentyl furan in the range 56 to 89 µg/kg, although these results are indicative due to the low recovery determined.

### **7.7.2 Other breakfast cereals**

Three samples of traditional breakfast cereal were analysed for furans in both survey years (Table 22). In both years all three samples contained low levels of furan and 2-methylfuran. In Year 1 the extruded multigrain hoops also contained low levels of 3-methylfuran and ethylfuran.

Cornflakes contained 55 µg/kg furan and 19 µg/kg 2-methylfuran in Year 1 and 25 µg/kg furan and 8.9 µg/kg 2-methylfuran in Year 2. Wheat biscuit contained 21 µg/kg furan and 15 µg/kg 2-methylfuran in Year 1 and 16.5 µg/kg furan and 16.1 µg/kg 2-methylfuran in Year 2. The multigrain hoops contained 35 µg/kg (furan), 17 µg/kg (2-MF), 5 µg/kg 3MF and 14 µg/kg (ethylfuran) in Year 1 and 17.4 µg/kg furan and 8 µg/kg 2-methylfuran in Year 2.

No other furans were detected in any of the samples above the LOQ.

### **7.7.3 Other fine bakery products (Crackers, biscuits etc)**

Five samples of crackers, rye bread, oat cakes and shortbread were analysed each year (Table 23). No furans were detected in the shortbread sample in Year 1, although furan was detected at a very low level in Year 2. Furan levels in the other four samples ranged from 5 to 158 µg/kg in Year 1 and <5 to 121 µg/kg in Year 2.

In Year 1 four samples contained 2MF, from 6 to 116 µg/kg, two samples contained 3MF and two contained ethylfuran. In Year 2 four samples contained 2MF, from 10 to 82 µg/kg, two samples contained 3MF and these also contained ethylfuran. Propyl furan and butyl furan were not detected in any sample. 2,5DMF was found in only one sample at a very low level in Year 1 (dark rye bread). This sample also contained the highest levels of furan (158 µg/kg) and 2MF (116 µg/kg), as well as lower amounts of 3MF (36 µg/kg) and 2DMF (5 µg/kg).

2,3DMF, propylfuran and butylfuran were not detected in any sample. The two samples that contained rye both contained pentylfuran, at levels of 135 and 171 µg/kg. Again, these values are indicative due to high recovery.

### **7.7.4 Coffees as sold and as consumed**

Overall nine ground coffees (6 in Year 1 and three in Year 2) and six instant coffees (four in Year 1 and two in Year 2) were analysed for furans. Samples were analysed 'as sold' and also 'as consumed', after making a beverage following the manufacturers' instructions. All results are given in Table 24 to Table 26.

For the instant coffees, furan was found in all samples in the range 41 µg/kg to 691 µg/kg. 2-methylfuran was the compound found at the highest concentrations in the instant coffees at levels from 231 to 3837 µg/kg.

3MF was found in four instant coffee samples at levels from 66 to 145 µg/kg, and 2,5-dimethyl furan was found at levels from 22 to 253 µg/kg. Ethylfuran was only found in one instant coffee at 23 µg/kg, propylfuran was not found in any of the samples above the LOQ. The LOQ was higher for some samples (<20 µg/kg) due to background interferences in these matrices.

In all cases virtually no furans were detected in the coffee beverages, five samples contained 2MF at low levels while none of the other compounds were present above the LOQ of 5 µg/kg.

The levels of furan were much higher in the roast coffee samples, however propylfuran and butylfuran were not detected in any sample above the LOQ (20 and 25 µg/kg respectively). Furan concentrations ranged from 2120 to 5076 µg/kg, 2MF levels ranged from 7666 to 20920 µg/kg, 3MF levels were from 399 to 825 µg/kg, ethylfuran levels were from 140 to 307 µg/kg, and 2DMF levels were from 717 to 1827 µg/kg. 2,3DMF levels were from 76 to 132 µg/kg. In Year 2 pentyl furan was detected in the three ground coffee samples at levels from 99 to 284 µg/kg, but these are indicative values as they were not confirmed by the qualifier ion.

The prepared beverages from the ground samples contained very low levels of furans compared to the product as sold. Ethylfuran and propylfuran were not detected at an LOQ of 5 µg/kg, 3MF and 2DMF were detected in most cases, but at levels just above the LOQ (range from 3.4 to 11 µg/kg). All samples analysed 'as consumed' contained furan and 2MF, but at levels from 18.7 to 75 µg/kg and 58 to 255 µg/kg, which were approximately 1-2% of the concentration in the dry ground coffee as sold.

#### **7.7.5 Baby food, ready meal pouches etc.**

In Year 1 ten samples of baby ready meals were analysed, both as sold and as prepared following the manufacturers' instructions. All heating conditions were used to prepare the 'as consumed' samples. Results are given in Table 27. The levels of furans found in the samples were low, the range of furan concentrations in the as purchased samples was from 22 to 42 µg/kg. For the ten samples from Year 2 furan levels ranged from 25.4 to 160 µg/kg for the samples as consumed.



2,5DMF propylfuran and butylfuran were not detected in any sample. Low levels of 2MF and 3MF were found, but none exceeded 19 µg/kg (both years), and for some samples these compounds were not detected. All samples contained ethylfuran, in Year 1 there was a broad range of concentrations from 8 to 259 µg/kg, in Year 2 levels ranged from 6.6 to 56.3 µg/kg. In Year 2 four samples contained pentylfuran above the LOQ at levels from 28 to 107 µg/kg (Table 28).

The results for the samples 'as consumed' were generally either very similar or lower than the 'as sold' levels. For the three samples with the highest ethylfuran concentrations the ethylfuran level in the heated products was considerably lower than the 'as sold' sample, for one sample it reduced from 259 µg/kg to 30 and 32 µg/kg for the two cooking methods used. There was one exception where the ethylfuran level in the portion of sample heated over water increased from 8 to 70 µg/kg, however the portion warmed in the microwave reduced to less than LOQ for all furans except furan.

Due to analytical issues with the Year 2 'as sold' sample analysis a lower sample weight was used for the 'as consumed' samples which resulted in better method performance. The 'as sold' samples were not re-analysed as the containers had been opened for the initial test.

#### **7.7.6 Processed cereal based food intended for infants and young children**

In both years ten samples of cereal based baby food were analysed, samples that would be reconstituted were analysed both as sold and as consumed. Results are reported in Table 29.

There was very little occurrence of furans in the cereal based infant foods. Two dry cereals contained very low levels of furans, but after reconstitution none were found above the LOQ. In Year one a sample of creamed porridge, sold as a wet food, contained low levels of furan, 2MF and ethylfuran, after warming only furan was detected at a similar level to the original sample. In Year 2 a jar of creamed porridge contained low levels of furan, 2MF, ethylfuran and pentylfuran. After warming these were present at similar levels to the original sample, except for pentylfuran which dropped from 29.7 µg/kg to <25 µg/kg. Baby rice and biscotti did not contain any furans as the dry cereal or after reconstitution. Low levels were found in two snacks, one contained furan, 2MF and ethyl furan just above the LOQ (5 to 7 µg/kg), while the other contained 33 µg/kg furan and 8 µg/kg 2MF.

#### **7.7.7 Vegetable crisps**

Five samples of vegetable crisps were analysed (Table 30). As for acrylamide analysis mixed products were split into their single vegetable components before analysis. Furan and ethylfuran were detected in all samples, furan levels ranged from 5 to 44 µg/kg and ethylfuran levels ranged from 5.9 to 29 µg/kg. 2MF was found in all but one sample analysed, levels range from 5 to 65 µg/kg. 3-MF was the next most frequently detected, found at levels from 5 to 10 µg/kg, 2,5DMF was only detected in three samples, all at a level around 8 µg/kg. Propylfuran was not detected in any samples in Year 1 but was detected in 5 test samples in Year 2 at levels from 5 to 6.7 µg/kg. 2,3DMF and butylfuran were not detected in any sample. Pentylfuran was detected in all samples in Year 2, however these could not all be confirmed as either the ion ratios did not confirm or the concentrations were out of range of the calibration curve. Confirmed results ranged from 57 to 193 µg/kg. The indicative / non-confirmed results ranged from 49 to 696 µg/kg. The beetroot samples tended to have the highest concentration of furans, but this is not conclusive as it was a very small sample set.

Despite using an isotopically labelled internal standard for pentylfuran, the analysis has not proved robust, with high and low recoveries, or interferences observed in the qualifier ion channel meaning results cannot be confirmed. Further work to improve the analysis of this analyte is required, and an alternative to headspace analysis should be assessed. Using a solvent extraction method followed by GC-MS could be a suitable approach.

#### **7.7.8 Other miscellaneous samples – soups**

Six samples of soup were analysed (Table 31). The soups were analysed as consumed, low levels of furan, were found in all samples. Two samples contained low levels of 2-MF (at 6.3 and 6.7 µg/kg), one sample contained 3-MF at 5.3 µg/kg and another contained ethylfuran at 7 µg/kg. None of the other furans were found in any of the samples above the respective LOQs.

#### **7.7.9 Other miscellaneous samples – fruit juices**

Eight samples of fruit juice were analysed for furans, five in Year 1 and three in Year 2 (Table 32), no furans were detected above the LOQ in any sample.

## 8. Summary and Conclusions

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8.1 A two year survey to produce exploratory data on the occurrence and levels of acrylamide and furans has been successfully completed.

8.2 In Year 1 162 samples were purchased, 130 were analysed for acrylamide and 60 were analysed for furans using methods accredited to ISO17025. In Year 2 a total 130 samples were purchased. Seventy eight samples were analysed for acrylamide only, twelve were analysed for furans only and forty were analysed for both acrylamide and furans using methods accredited to ISO17025.

8.3 A method was developed and validated to expand the scope of furan testing. In Year 1 this included the compounds furan, 2MF, 3MF, ethylfuran, 2,5DMF and propylfuran. The scope of the method for furan testing was further expanded in Year 2, following inclusion of additional isotopically labelled internal standards. The method now includes the compounds furan, 2MF, 3MF, ethylfuran, 2,5DMF, 2,3DMF, propylfuran, butylfuran and pentylfuran. The method has been accredited to ISO17025 using Flexible Scope.

8.4 The majority of samples analysed for acrylamide were chosen to address the need for exploratory data including for products listed in Recommendation (EU) 2019/1888 and therefore do not have BMLs. In both years the highest levels of acrylamide were observed in vegetable crisps, a veggie straw product, dry coffee, a sample of dried apricots, and a black olives sample. The results, overall, were very similar in Years 1 and 2.

8.5 There are no guidance levels or action levels for furans, the data from this study will be used to provide information where there are gaps in current understanding of occurrence. The majority of samples contained low levels of furans. The highest levels were observed in coffee, both ground and instant. When these were used to prepare beverages the resulting furan levels were much reduced, typically around 1-2% of the levels in the dry coffee. For foods such as baby ready meals, and ready to eat soups, low levels of furan were found.

8.6 Pentylfuran was detected in many types of samples in Year 2. Highest levels were observed in vegetable crisps, coffee and rye breads. Despite using an isotopically labelled pentylfuran standard the method performance was variable, with high and low recoveries for spiked samples, and interferences observed. This meant some results could not be confirmed and most were reported as indicative. Further work on methodology for pentylfuran is recommended to address these issues.

8.6 This data gives a snapshot of the levels of processing contaminants in a range of products. The results show a high degree of agreement between Year 1 and 2, with the same or similar products being found to contain very similar levels of acrylamide, furans and in some cases, e.g. vegetable crisps, both compounds. This exploratory data provides information that may be used to design future sampling studies and to support decision making in the possible setting of future regulatory levels.

## 9. Acknowledgements

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## Annex 1: Tables

**Table 1. Sampling Plan for Acrylamide and Furan survey – Years 1 and 2**

Group Descriptor	Descriptor	Year 1 Acrylamide	Year 1 Furan, Alkyfurans	Year 2 Acrylamide	Year 2 Furan, Alkyfurans
Potato Crisps, snacks, crackers and other potato products from potato dough	-	-	5	-	5
Bread	e.g. Pumpnickel, Ciabatta with olives, onion bread	5	-	12	-
	e.g. Rolls (milk rolls)	4	-	-	-
	e.g. Pita bread	3	-	-	-
Breakfast Cereals excluding porridge	Honey roasted muesli	2	-	2	-
	Other breakfast cereals	3	3	3	3
Fine Bakery Wares (excluding cakes and pastry)	Croissants	5	-	11	-
	Doughnuts	5	-	11	-
	Pancakes	5	-	11	-
	Churros	3	-	11	-
	Other fine bakery products (Crackers, biscuits etc)	5	5	5	5
Coffee	as sold and as consumed	10	10	5	5

**Table 1. Contd. Sampling Plan for Acrylamide and Furan survey**

<b>Group Descriptor</b>	<b>Descriptor</b>	<b>Year 1 Acrylamide</b>	<b>Year 1 Furan, Alkylfurans</b>	<b>Year 2 Acrylamide</b>	<b>Year 2 Furan, Alkylfurans</b>
Coffee Substitutes	Products not based on chicory or cereals	5	5	-	-
Baby foods and processed cereal based food intended for infants and young children.	Savoury ready meals (jars, pouches etc.)	-	10	10	10
	Baby foods e.g. rice, porridge, rusks	-	10	10	10
Other products based on cereals and potatoes	Mexican Tortillas	3	-	-	-
	Cereal Snacks (e.g. Rice Cakes, Rice Crackers, Maize Crackers etc)	10	-	5	-
	Potato Products e.g. rosti, croquettes	10	-	5	-
	Potato based ready meals (e.g. potato and cheese, casserole, potato and meat)	5	-	3	-

**Table 1. Contd. Sampling Plan for Acrylamide and Furan survey**

<b>Group Descriptor</b>	<b>Descriptor</b>	<b>Year 1 Acrylamide</b>	<b>Year 1 Furan, Alkyfurans</b>	<b>Year 2 Acrylamide</b>	<b>Year 2 Furan, Alkyfurans</b>
Others	Roasted Nuts	4	-	4	-
Others	Roasted Oilseeds	3	-	3	-
Others	Dried Fruits	5	-	5	-
Others	Roasted cocoa beans and derived products	3	-	3	-
Others	Olives in brine	3	-	3	-
Others	Confectionary for example, fudge, caramel, nougat	4	-	2	-
Others	Vegetable Crisps	5	5	7	7
Others	Vegetable Fries/chips	5	-	5	-
Others	Snacks intended for infants and young children	15	-	15	-
Others	Ready to eat soup (as consumed)	-	2	-	4
Others	Fruit Juices	-	5	-	3

Total samples: 162 Year 1, 130 Year 2



**Table 2. Acrylamide results for Bread products – Year 1 (µg/kg) corrected for recovery.**

<b>Laboratory sample code</b>	<b>Product description</b>	<b>Brand name</b>	<b>Group Descriptor</b>	<b>Acrylamide Result (µg/kg)</b>
S20-033759	Pumpkin Seed Sourdough Bread	The Polish Bakery	Pumpernickel, Ciabatta with olives, onion bread	78
S20-033760	Cranberry, Raisin & Cashew Bloomer Loaf	Tesco	Pumpernickel, Ciabatta with olives, onion bread	<30
S20-033761	Organic Millet Wholegrain Bread	Biona	Pumpernickel, Ciabatta with olives, onion bread	<30
S20-033747	Milk Roll Sliced White Bread	Warburtons	Rolls (milk rolls)	<30
S20-033748	Bon Appetit Milk Brioche Rolls	Aldi	Rolls (milk rolls)	<30
S20-033749	Brioche Rolls	Brioche Pasquier	Rolls (milk rolls)	<30
S20-033750	Maitre Jean Pierre Brioche Rolls	Lidl	Rolls (milk rolls)	<30
S20-033751	Wholemeal Pittas	Asda	Pitta Bread	<30
S20-033752	Pitta Breads Stone Baked	BFree	Pitta Bread	<30
S20-033753	Grains & Goodness Pitta	The Food Doctor	Pitta Bread	<30

**Table 3. Acrylamide results for Bread products – Year 2 (µg/kg) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S21-029481	Olive Bloomer*	Tesco	Olive Bread	50.8
S21-030122	Green Olive Loaf Slices	Seedful	Olive Bread	<30
S21-030128	Caramelised Red Onion & Mozzarella Flatbread	Asda Extra Special	Other Bread	<30
S21-030363	Olive Ciabatta	Tesco	Olive Bread	<30
S21-030432	Rye & Buckwheat Boule*	Sainsbury's Taste the Difference	Rye Bread	<30
S21-031498	Olive Rolls*	Waitrose and Partners	Olive Bread	94
S21-031593	Rye Loaf	M&S	Rye Bread	<30
S21-031870	Kalamata Olive Bloomer*	Sainsbury's Taste the Difference	Rye Bread	60.6
S21-031865	Organic Sunflower Seed Bread	Mestemacher	Other Bread	<30
S21-031869	Cranberry, Raisin & Cashew Bloomer	Tesco	Other Bread	<30

(\* n=3)

Retained Commission Regulation (EU) 2017/2158 sets Benchmark levels for 'Bread' as follows:

- Soft bread
- (a) Wheat based bread 50 µg/kg
  - (b) Soft bread other than wheat based bread 100 µg/kg

**Table 4. Acrylamide results for Bread products – Comparison of products sampled Years 1 and 2, results in (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033758	Year 1	Whole Grain Rye Bread	Schneider Brot	Pumpernickel, Ciabatta with olives, onion bread	<30
S21-029606	Year 2	Whole Grain Rye Bread	Schneider Brot	Rye Bread	<30
S20-033723	Year 1	Kalamata Olive Ciabatta	Sainsbury's Taste The Difference	Pumpernickel, Ciabatta with olives, onion bread	89
S21-030362	Year 2	Olive Ciabatta	Sainsbury's Taste the Difference	Olive Bread	44.7

Retained Commission Regulation (EU) 2017/2158 sets Benchmark levels for 'Bread' as follows:

- Soft bread
- (a) Wheat based bread 50 µg/kg
  - (b) Soft bread other than wheat based bread 100 µg/kg.

**Table 5. Acrylamide results for Breakfast cereals excluding porridge - Comparison of products sampled Years 1 and 2, results in (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033754	Year 1	Simply Granola	Jordans	Honey roasted muesli	106
S21-029604	Year 2	Honey Granola	Jordans	Honey roasted muesli	121
S20-033755	Year 1	Honey Granola	Dorset Cereal	Honey roasted muesli	51
S21-030360	Year 2	Honey Granola	Dorset Cereals	Honey roasted muesli	79.5
S20-033826	Year 1	Cornflakes	Kellogg's	Other cereal	49
S21-029925	Year 2	Corn Flakes	Kellogs	Other cereal	55.4
S20-033828	Year 1	Cheerios	Nestle	Other cereal	132
S21-030364	Year 2	Multigrain Cheerios*	Nestle	Other cereal	194*
S20-033827	Year 1	Weetabix	Weetabix	Other cereal	278
S21-030722	Year 2	Weetabix	Weetabix	Other cereal	286

(\* n=3)

Retained Commission Regulation (EU) 2017/2158 sets BMLs for 'Breakfast cereals (excl. porridge)' as follows:

Breakfast cereals (excl. porridge)

- bran products and whole grain cereals, gun puffed grain 300 µg/kg
- wheat and rye based products 300 µg/kg
- maize, oat, spelt, barley and rice based products 150 µg/kg

**Table 6. Acrylamide results for Fine Bakery Wares (excluding cakes and pastry) – Comparison of products sampled in Years 1 and 2, results in (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033762	Year 1	Reduced Fat All Butter Croissants	Marks & Spencer	Croissants	<30
S20-033763	Year 1	Luxury All-Butter Croissants	Iceland	Croissants	<30
S20-033764	Year 1	Vegan Croissants	La Boulangerie	Croissants	<30
S20-033765	Year 1	Croissants	Tesco	Croissants	<30
S20-033766	Year 1	All Butter Croissants	Aldi	Croissants	31
S21-029612	Year 2	Butteries	Murdoch Allan	Croissants	52.6
S21-029831	Year 2	Butter Croissants	Iceland	Croissants	<30
S21-031497	Year 2	Butter Croissants	Aldi	Croissants	<30
S20-033724	Year 1	Doughnuts (ring)	Krispy Kreme	Doughnuts	<30
S20-033725	Year 1	Raspberry Jam Doughnuts	Sainsbury's	Doughnuts	<30
S20-033726	Year 1	Chocolate Flavoured Iced Ring Doughnuts	Tesco	Doughnuts	<30
S20-033772	Year 1	Custard Filled Doughnuts	Co-op	Doughnuts	<30
S20-033727	Year 1	Jam Filled Doughnuts	Lidl	Doughnuts	<30
S21-029607	Year 2	Sugar Ring Doughnuts	M&S	Doughnuts	<30

**Table 6. contd. Acrylamide results for Fine Bakery Wares (excluding cakes and pastry) – Comparison of products sampled in Years 1 and 2, results in (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033767	Year 1	Scotch Pancakes	Asda	Pancakes	<30
S20-033768	Year 1	Pancakes	Warburtons	Pancakes	<30
S20-033769	Year 1	Village Bakery Scotch Pancakes	Aldi	Pancakes	73
S20-033770	Year 1	Scotch Pancakes	Hovis	Pancakes	<30
S20-033771	Year 1	Large Buttermilk Pancakes	Sainsburys	Pancakes	<30
S21-030632	Year 2	Buttermilk Pancakes	Lidl	Pancakes	196
S21-030302	Year 2	Chocolate Eclairs	Morrisons	Eclairs	36.8
S21-030431	Year 2	Raisin Whirls	Sainsburys	Danishes	<30
S21-030609	Year 2	Chocolate Eclairs	Tesco	Eclairs	56.0
S20-033803	Year 1	Mini Churros	Sol & Mar	Churros	<30
S20-033804	Year 1	Churros Lazo	Chulaz	Churros	71
S20-033805	Year 1	Churros with Cinnamon Sprinkle & Chocolate Dip	Marks & Spencer	Churros	60
S21-030715	Year 2	Yum Yums	Sainsbury's	Yum Yums	118
S21-030129	Year 2	Churros	Lidl	Churros	<30
S21-031500	Year 2	Yum Yums	Waitrose	Yum Yums	<30

**Table 6. contd. Acrylamide results for Fine Bakery Wares (excluding cakes and pastry) – Comparison of products sampled in both years, results in (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033829	Year 1	Cream Crackers	Jacob's	Other - Crackers, biscuits etc.	66
S21-029601	Year 2	Cream Crackers	Lidl	Crackers, biscuits etc.	117
S20-033830	Year 1	Orkney Thick Oatcakes	Stockan's	Other - Crackers, biscuits etc.	236
S21-030366	Year 2	Thick Oatcakes	Stockan's	Crackers, biscuits etc.	182
S20-033833	Year 1	Deluxe Scottish Shortbread	Lidl	Other - Crackers, biscuits etc.	<30
S21-030300	Year 2	Butter Shortbread Fingers	Morrisons	Crackers, biscuits etc.	<30
S20-033831	Year 1	Gluten Free Wholegrain Crackers	Nairns	Other - Crackers, biscuits etc.	42
S21-030627	Year 2	Wholegrain Rye Crispbread	Lidl	Crackers, biscuits etc.	326
S20-033832	Year 1	Dark Rye Crunchy Rye Breads	Ryvita	Other - Crackers, biscuits etc.	218
S21-030605	Year 2	Dark Rye Crispbread	Ryvita	Crackers, biscuits etc.	238

Retained Commission Regulation (EU) 2017/2158 sets BMLs as follows:

Biscuits and wafers	350 µg/kg
Crackers with the exception of potato based crackers	400 µg/kg
Crispbread	350 µg/kg
Ginger bread	800 µg/kg
Products similar to the other products in this category	300 µg/kg

There are no BMLs for doughnuts and croissants.

**Table 7. Acrylamide results for Coffee Year 1 – as sold (µg/kg) and as consumed (µg/L), corrected for recovery.**

Laboratory sample code	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg) As sold	Acrylamide Result (µg/L) As consumed
S20-033834	Decaff Coffee (instant)	Kenco	Coffee	884	4.7
S20-033838	Origins Alta Rica Coffee (instant)	Nescafe Gold	Coffee	688	5.7
S20-033840	Instant Coffee	Aldi Alcafe	Coffee	646	6.0
S20-033843	Pure Gold Instant Coffee	Douwe Egberts	Coffee	849	7.7
S20-033835	Machu Picchu Ground Coffee	Café Direct	Coffee	245	11.6
S20-033836	Classic Roast Ground Coffee	Illy	Coffee	183	13.2
S20-033837	Americano Organic Ground Coffee	Percol	Coffee	163	9.3
S20-033839	Rich Italian Ground Coffee	Taylors	Coffee	178	9.5
S20-033841	Qualita Rossa (Ground coffee)	Lavazza	Coffee	356	18.1
S20-033842	Mocha Italia Signature Blend (Ground)	Costa Coffee	Coffee	197	10.7

Retained Commission Regulation (EU) 2017/2158 sets Benchmark levels as follows:

Roast coffee                      400 µg/kg

Instant (soluble) coffee      850 µg/kg

The BML applies to the product as sold.



**Table 8. Acrylamide results for Coffee Year 2– as sold (µg/kg) and as consumed (µg/L), corrected for recovery.**

Laboratory sample code	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg) As sold	Acrylamide Result (µg/L) As consumed
S21-029483	Decaff Coffee (Instant)	Kenco	Coffee	687	5.3
S21-029838	Roast Instant Coffee	Aldi	Coffee	443	4.7
S21-030299	Ground Coffee	Café Direct	Coffee	289	13.9
S21-029832	Ground Coffee	Lavazza	Coffee	305	10.8
S21-030437	Roast Coffee	Costa	Coffee	127*	4.8

(\* n=2)

Retained Commission Regulation (EU) 2017/2158 sets Benchmark levels as follows:

Roast coffee                      400 µg/kg

Instant (soluble) coffee      850 µg/kg

The BML applies to the product as sold.

**Table 9. Acrylamide results for Coffee substitutes (Products not based on chicory or cereals) – as sold ( $\mu\text{g}/\text{kg}$ ), and as consumed, ( $\mu\text{g}/\text{L}$ ) corrected for recovery**

Laboratory sample code	Product description	Brand name	Group Descriptor	Acrylamide Result ( $\mu\text{g}/\text{kg}$ ) As sold	Acrylamide Result ( $\mu\text{g}/\text{L}$ ) As consumed
S20-033844	Dandelion Coffee Compound	Symingtons	Coffee substitute	<30	0.6
S20-033845	Acorn Coffee Substitute	Health Embassy	Coffee substitute	<30	1.9
S20-033846	Organic Latte Turmeric Gold	Pukka	Coffee substitute	57	2.1
S20-033847	Turmeric Latte Mix	Nature's Harvest	Coffee substitute	<30	<0.3
S20-033848	Matcha Latte Mix	Naturals	Coffee substitute	<30	<0.3

Retained Commission Regulation (EU) 2017/2158 sets Benchmark levels as follows:

Coffee substitutes:

- (a) coffee substitutes exclusively from cereals 500  $\mu\text{g}/\text{kg}$
- (b) coffee substitutes from a mixture of cereals and chicory (#)
- (c) coffee substitutes exclusively from chicory 4 000  $\mu\text{g}/\text{kg}$

# The benchmark level to be applied to coffee substitutes from a mixture of cereals and chicory takes into account the relative proportion of these ingredients in the final product.

**Table 10. Acrylamide results for Baby foods intended for infants and young children – savoury meals (as bought) ( $\mu\text{g}/\text{kg}$ ) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Group Descriptor	Acrylamide Result ( $\mu\text{g}/\text{kg}$ )
S21-029835	Spaghetti Bolognese	Asda little angels	Baby food savoury ready meals	<30
S21-029836	Chicken casserole with rice	Mamia Organic	Baby food savoury ready meals	<30
S21-029922	Chicken & Sweet Potato Curry	For Aisha	Baby food savoury ready meals	35.5
S21-030436	Vegetable & Lentil Bake	Ella's Kitchen	Baby food savoury ready meals	<30
S21-030607	Sunday Chicken Dinner	Heinz	Baby food savoury ready meals	<30
S21-030634	Organic Vegetables with Rice and Chicken	HiPP Organic	Baby food savoury ready meals	<30
S21-030717	Cottage Pie	Ella's Kitchen	Baby food savoury ready meals	<30
S21-030724	Sweet Potato Chicken and Veggies	Heinz	Baby food savoury ready meals	<30
S21-030725	Organic Butternut Squash Mac & Cheese	Piccolo	Baby food savoury ready meals	<30
S21-030726	Vegetable Risotto	Babease	Baby food savoury ready meals	<30

**Table 11. Acrylamide results for Baby foods and processed cereal based food intended for infants and young children (as bought), µg/kg, corrected for recovery.**

Laboratory sample code	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S21-029482	Rusks	Farleys	Infant cereal based product	<30
S21-029486	Organic Apple and Banana Bircher Muesli	HiPP Organic	Infant cereal based product	<30
S21-029611	Baby rice	Cow & Gate	Infant cereal based product	<30
S21-029923	Biscotti Banana*	Kiddylicious	Infant cereal based product	276*
S21-030124	Creamed porridge (ready made)	Heinz	Infant cereal based product	<30
S21-030606	Creamy Porridge	HIPP Organic	Infant cereal based product	<30
S21-030714	Vanilla and banana biscuits*	Ella's Kitchen	Infant cereal based product	232*
S21-030723	Teething Biscuits	Bickiepegs	Infant cereal based product	<30
S21-031094	Organic Baby Rice	Aptamil	Infant cereal based product	<30
S21-031495	Organic Apple Biscotti*	Mamia Organic	Infant cereal based product	259*

(\* n=3)

**Table 12. Acrylamide results for products based on potatoes, Year 1 (cooked), results in µg/kg, corrected for recovery**

<b>Laboratory sample code</b>	<b>Product description</b>	<b>Brand name</b>	<b>Group Descriptor</b>	<b>Acrylamide Result (µg/kg)</b>
S20-033806	Jacket Potatoes	McCain	Potato products (microwave)	228
S20-033806	Jacket Potatoes	McCain	Potato products (oven)	1097
S20-033807	Potato Croquettes	Iceland	Potato products (deep fried)	409
S20-033807	Potato Croquettes	Iceland	Potato products (oven)	<30
S20-033808	Hash Browns	McCain	Potato products	176
S20-033809	Potato Croquettes	Tesco	Potato products	39
S20-033810	Potato Gratin	Aldi	Potato products (microwave)	<30
S20-033810	Potato Gratin	Aldi	Potato products (oven)	39
S20-033811	Sauteed potatoes with bacon & onions	Lidl	Potato products	322
S20-033812	Potato Waffles	Morrisons	Potato products (Deep fried)	328
S20-033812	Potato Waffles	Morrisons	Potato products (Oven)	82
S20-033813	Roasties	Aunt Bessie's	Potato products (Deep fried)	152
S20-033813	Roasties	Aunt Bessie's	Potato products (Oven)	86
S20-033814	Crispy Potato Pops	Tesco	Potato products	58
S20-033815	Crisp & Golden Swiss Style Rosti	Waitrose	Potato products	374

**Table 12 contd. Acrylamide results for products based on potatoes, Year 1 (cooked), results in µg/kg, corrected for recovery**

<b>Laboratory sample code</b>	<b>Product description</b>	<b>Brand name</b>	<b>Group Descriptor</b>	<b>Acrylamide Result (µg/kg)</b>
S20-033816	Cheese & Bacon Potato Skins	Bannisters	Potato based ready meal (microwave)	104
S20-033816	Cheese & Bacon Potato Skins	Bannisters	Potato based ready meal (oven)	130
S20-033817	Potato Dauphinoise	Tesco Finest	Potato based ready meal	<30
S20-033818	Nature's Pick, Crispy Potato Slices	Aldi	Potato based ready meal	218
S20-033819	Deluxe Cottage Pie	Lidl	Potato based ready meal	34
S20-033820	Sausage & Mash	Tesco Hearty Food Co.	Potato based ready meal (microwave)	<30
S20-033820	Sausage & Mash	Tesco Hearty Food Co.	Potato based ready meal (oven)	<30

**Table 13. Acrylamide results for products based on potatoes, Year 2 (as purchased) results in µg/kg, corrected for recovery**

<b>Laboratory sample code</b>	<b>Product description</b>	<b>Brand name</b>	<b>Group Descriptor</b>	<b>Acrylamide Result (µg/kg)</b>
S21-029614	Cheddar Cheese Croquettes	Inspired Cuisine	Potato products	50.8
S21-030303	Frozen Baked Jacket Potatoes	McCain	Potato products	84.1
S21-030433	Hash Browns	McCain	Potato products	67.1
S21-030611	Potato Waffles <sup>#</sup>	Birds Eye	Potato products	88.9 <sup>#</sup>
S21-031597	Mini Roasties	Aunt Bessie's	Potato products	<30
S21-030126	Potato Dauphinoise	Deluxe	Potato products	<30
S21-030635	Cheese & Bacon Potato Skins	Sainsbury's	Potato based ready meals	106
S21-031493	Cottage Pie	Charlie Bighams	Potato based ready meals	<30

(# n=2)

**Table 14. Acrylamide results for Other products based on cereals and potatoes cereal snacks, Years 1 and 2, results in µg/kg, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033773	Year 1	White Wraps	Weight Watchers	Mexican Tortillas	<30
S20-033774	Year 1	Wheat & White Wraps	Mission Deli	Mexican Tortillas	<30
S20-033775	Year 1	Regular Tortillas Whole Wheat	Old El Paso	Mexican Tortillas	<30
S20-033728	Year 1	Rice Cakes	Marmite	Cereal Snacks	222
S20-033729	Year 1	Salt & Vinegar Rice Cakes	Snack A Jacks	Cereal Snacks	90
S20-033730	Year 1	Blueberry & Vanilla Low Fat Rice & Corn Cakes	Kallo	Cereal Snacks	153
S20-033731	Year 1	Sweet Chilli Rice Crackers	The Snack Organisation	Cereal Snacks	70
S20-033732	Year 1	Rice Cakes	Harvest Morn Aldi	Cereal Snacks	183
S20-033733	Year 1	Just Free GF Corn Cakes	Lidl	Cereal Snacks	215
S20-033734	Year 1	Belgian Dark Chocolate Rice Cakes	Nature's Store	Cereal Snacks	152
S20-033735	Year 1	Thai Chilli Rice Crackers	Marks & Spencer	Cereal Snacks	<30
S20-033756	Year 1	Chilli Rice Crackers	Three Tigers	Cereal Snacks	<30
S20-033736	Year 1	Corn Thins	Real Food	Cereal Snacks	414
S21-029830	Year 2	Rice and Corn Cakes	Kallo	Rice cakes	286
S21-029833	Year 2	Rice cakes with yogurt flavoured coating	Harvest Morn	Rice cakes	81.5
S21-030430	Year 2	Marmite Rice Cakes*	Kallo	Rice cakes	308*
S21-030434	Year 2	Sweet Chilli Rice Crackers	The Snack Organisation	Rice cakes	93.5
S21-030630	Year 2	Salt & Vinegar Rice Cakes	Snack a Jacks	Rice cakes	110

(\* n=3)



**Table 15. Acrylamide results for snacks intended for children, Year 1 and 2, results in µg/kg, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033776	Year 1	Organic Carrot Sticks	Lupilu	Snacks intended for infants and young children	182
S21-031867	Year 2	Carrot Sticks*	Organix	Infant cereal based product	135*
S20-033777	Year 1	Strawberry & Apple Oat Fingers	Ella's Kitchen	Snacks intended for infants and young children	<30
S21-031858	Year 2	Blackcurrant + beetroot oat bars	Ella's kitchen	Infant cereal based product	<30
S20-033778	Year 1	(Mini) Rice Cakes 12+ months	Marmite	Snacks intended for infants and young children	<30
S21-030628	Year 2	Apple Rice Cakes*	Organix	Infant cereal based product	33.7*
S20-033779	Year 1	Apple & Carrot Rice Crispy Sticks	Kiddylicious	Snacks intended for infants and young children	68
S21-031861	Year 2	Apple and carrot, rice sticks	Kiddylicious	Infant cereal based product	<30
S20-033780	Year 1	Strawberry & Apple Soft Oaty Bars	Mamia Organic	Snacks intended for infants and young children	<30
S21-029920	Year 2	Organic carrot cake oat bars	Mamia Organic	Infant cereal based product	<30
S20-033781	Year 1	Organic Blueberry Flavour Rice Cakes	Asda Little Angels	Snacks intended for infants and young children	<30
S21-031866	Year 2	Cheese and Onion snack*	Organix	Infant cereal based product	119*
S20-033782	Year 1	So Yummy Tomato & Basil Straws	Heinz	Snacks intended for infants and young children	<30
S21-031863	Year 2	Cerelac, Wheat, Oat & Carrot Snack	Nestle Cerelac	Infant cereal based product	<30
S20-033783	Year 1	Apple Rice Cakes	Organix	Snacks intended for infants and young children	<30
S21-031499	Year 2	Banana & Cocoa Oat Bars	Piccolo	Infant cereal based product	<30

**Table 15. contd. Acrylamide results for snacks intended for children, Year 1 and 2, results in µg/kg, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033784	Year 1	Veggie Straws	Eat Real	Snacks intended for infants and young children	2439*
S21-029615	Year 2	Veggie Straws*	Eat Real	Infant cereal based product	1738*
S20-033785	Year 1	Chickpea & Carrot Puffs	Tesco	Snacks intended for infants and young children	41
S21-030301	Year 2	Carrot Puffs*	Organix	Infant cereal based product	140*
S20-033786	Year 1	Raspberry & Apple Oaty Bars	Organix	Snacks intended for infants and young children	<30
S21-031592	Year 2	Organic Blackcurrant Oat Bars	Organix	Infant cereal based product	<30
S20-033787	Year 1	Sweetcorn & Carrot Melty Sticks	Ella's Kitchen	Snacks intended for infants and young children	96
S21-031862	Year 2	Sweetcorn & Carrot Seed Tubes	Little Freddie	Infant cereal based product	36.6
S20-033788	Year 1	Wheat, Oat & Tomato Cereal Snack	Nestle Cerelac	Snacks intended for infants and young children	<30
S21-030626	Year 2	Organic Cheese and Leek Multigrain*	Ella's Kitchen	Infant cereal based product	37.6
S20-033789	Year 1	Tomato, Paprika, Chickpea & Quinoa Smiles	Little Freddie	Snacks intended for infants and young children	<30
S21-031859	Year 2	Veggie sticks*	Organix	Infant cereal based product	80.4*
S20-033790	Year 1	Banana Puffcorn	Organix	Snacks intended for infants and young children	144
S21-031860	Year 2	Carrot + Lentil Sticks*	Ella's Kitchen	Infant cereal based product	110*

(\*n=3)

**Table 16. Acrylamide results for Vegetable crisps, Year 1 and Year 2, results in µg/kg, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033849	Year 1	Hummus Chips	Eat Real	Vegetable Crisps	<30
S21-031546	Year 2	Hummus chips	Eat Real	Vegetable Crisps	<30
S20-033853	Year 1	Lentil Bites	The Foodie Market	Vegetable Crisps	95
S21-030298	Year 2	Lentil Chips	The Daily Crave	Vegetable Crisps	276
S21-030435	Year 2	Sea Salt Lentil chips	Proper	Vegetable Crisps	79.1
S21-029608	Year 2	Shitake Mushroom Crisps	DJ&A	Vegetable Crisps	<30
S20-033850	Year 1	Veg Crisps - Beetroot	Tyrells	Vegetable Crisps	1249*
S20-033850	Year 1	Veg Crisps - Carrot	Tyrells	Vegetable Crisps	830*
S20-033850	Year 1	Veg Crisps - Parsnip	Tyrells	Vegetable Crisps	160
S21-030297	Year 2	Veg crisps – carrot*	Tyrrells	Vegetable Crisps	2464*
S21-030297	Year 2	Veg crisps – beetroot*	Tyrrells	Vegetable Crisps	586*
S21-030297	Year 2	Veg crisps – parsnip*	Tyrrells	Vegetable Crisps	77.8*

(\*n = minimum of 3 determinations)

**Table 16. contd. Acrylamide results for Vegetable crisps, Year 1 and Year 2, results in µg/kg, (µg/kg) corrected for recovery.**

<b>Laboratory sample code</b>	<b>Sampling Year</b>	<b>Product description</b>	<b>Brand name</b>	<b>Group Descriptor</b>	<b>Acrylamide Result (µg/kg)</b>
S20-033851	Year 1	Root Vegetable & Sea Salt Crisps - Beetroot	Aldi	Vegetable Crisps	1349*
S20-033851	Year 1	Root Vegetable & Sea Salt Crisps - Parsnip	Aldi	Vegetable Crisps	726*
S20-033851	Year 1	Root Vegetable & Sea Salt Crisps - Sweet Potato	Aldi	Vegetable Crisps	536
S21-031496	Year 2	Vegetable Crisps with Sea Salt – parsnip*	Aldi	Vegetable Crisps	490*
S21-031496	Year 2	Vegetable Crisps with Sea Salt – beetroot*	Aldi	Vegetable Crisps	1026*
S21-031496	Year 2	Vegetable Crisps with Sea Salt – carrot*	Aldi	Vegetable Crisps	1191*
S20-033852	Year 1	Lightly Salted Veg Chips - Beetroot	Kettle	Vegetable Crisps	2634*
S20-033852	Year 1	Kettle Lightly Salted Veg Chips- Parsnip	Kettle	Vegetable Crisps	2293*
S20-033852	Year 1	Kettle Lightly Salted Veg Chips -Sweet Potato	Kettle	Vegetable Crisps	1668*
S21-030719	Year 2	Veg Chips Lightly Salted – parsnip*	Kettle	Vegetable Crisps	2114*
S21-030719	Year 2	Veg Chips Lightly Salted – beetroot*	Kettle	Vegetable Crisps	1456*
S21-030719	Year 2	Veg Chips Lightly Salted – sweet potato*	Kettle	Vegetable Crisps	597*

(\* n=3)

**Table 17. Acrylamide results for Year 1 and 2 –vegetable chips/fries (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033822	Year 1	Mixed Root Vegetable Fries – Beetroot (cooked)	Strong Roots	Vegetable Fries/chips	249
S20-033822	Year 1	Mixed Root Vegetable Fries – Carrot (cooked)	Strong Roots	Vegetable Fries/chips	229
S20-033822	Year 1	Mixed Root Vegetable Fries – Parsnip (cooked)	Strong Roots	Vegetable Fries/chips	108
S21-030612	Year 2	Mixed Root Vegetable Fries – beetroot (as sold)	Strong Roots	Vegetable fries/chips	30
S21-030612	Year 2	Mixed Root Vegetable Fries – carrot (as sold)	Strong Roots	Vegetable fries/chips	33.1
S21-030612	Year 2	Mixed Root Vegetable Fries – parsnip (as sold)	Strong Roots	Vegetable fries/chips	<30
S20-033824	Year 1	Crispy Sweet Potato Fries (cooked)	McCain	Vegetable Fries/chips	35
S21-031494	Year 2	Sweet Potato Fries (as sold)	McCain	Vegetable fries/chips	<30
S20-033825	Year 1	Sweet Potato Chips (cooked)	Slimming World	Vegetable Fries/chips	321
S21-031596	Year 2	Sweet Potato Chips (as sold)	Slimming World	Vegetable fries/chips	58.6
S20-033823	Year 1	Four Seasons Battered Onion Rings (cooked)	Aldi	Vegetable Fries/chips (oven)	<30
S20-033823	Year 1	Four Seasons Battered Onion Rings (cooked)	Aldi	Vegetable Fries/chips (deep fried)	63
S21-030127	Year 2	Onion Rings (as sold)	Asda	Vegetable fries/chips	58.5
S20-033821	Year 2	Honey Glazed Parsnips (cooked)	Aunt Bessie's	Vegetable Fries/chips	433
S21-030610	Year 2	Honey Glazed Parsnips (as sold)	Aunt Bessie's	Vegetable fries/chips	<30

**Table 18. Acrylamide results for Other products – Roasted nuts and oilseeds, Year 1 and Year 2, results in µg/kg, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033740	Year 1	Roasted & Salted Pistachio Nuts	Cypressa	Roasted Nuts	<30
S20-033741	Year 1	Roasted & Salted Cashews	Stockwell	Roasted Nuts	<30
S20-033742	Year 1	Mixed Nuts	Aldi	Roasted Nuts	<30
S20-033743	Year 1	Roasted Peanuts	Tesco	Roasted Nuts	92
S21-029602	Year 2	Mixed Nuts	Alesto	Roasted nuts	<30
S21-029921	Year 2	Roasted and salted almonds, peanuts, hazelnuts, cashew nuts and pecans.	Clancy's	Roasted nuts	77.7
S21-030121	Year 2	Roasted Salted Pistachio Nuts	Wonderful	Roasted nuts	44.7
S21-030359	Year 2	Cashews Salted	KP	Roasted nuts	<30
S20-033744	Year 1	Toasted 3 Seed Mix	Tesco	Roasted Oilseeds	<30
S20-033757	Year 1	Toasted Pumpkin & Sunflower Seeds	Sainsbury's	Roasted Oilseeds	<30
S20-033746	Year 1	Chilli Roasted Pumpkin & Sunflower Seeds	Munchy Seeds	Roasted Oilseeds	<30
S21-030631	Year 2	Honey Roasted Pumpkin and Sunflower Seeds	Munchy Seeds	Roasted oil seeds	70
S21-031093	Year 2	Toasted pumpkin & sunflower seeds	Sainsbury's	Roasted oil seeds	<30
S21-031545	Year 2	Roasted & salted Pumpkin Seeds	Cypressa	Roasted oil seeds	<30

**Table 19. Acrylamide results for Other products –dried fruit and roasted cocoa beans, Year 1 and 2, results in µg/kg, corrected for recovery**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033791	Year 1	Chopped Dates	Whitworths	Dried fruit	48
S20-033792	Year 1	Organic Soft Apricots	Crazy Jack	Dried fruit	454
S20-033793	Year 1	Mango (Dried)	Urban Fruit	Dried fruit	<30
S20-033794	Year 1	Strawberry Yoyos	Bear	Dried fruit	<30
S20-033795	Year 1	Alesto Dried Mango	Lidl	Dried fruit	<30
S21-029485	Year 2	Stoned Dates	Whitworths	Dried fruit	73
S21-030624	Year 2	Organic Soft Apricots*	Crazy Jacks	Dried fruit	451*
S21-030625	Year 2	Baked Raspberries	Urban Fruit	Fruit product	<30
S21-030716	Year 2	Soft Apricots	Morrisons	Dried fruit	<30
S21-031548	Year 2	Oxford Whole Foods Diced Pineapple	Oxford Whole Foods	Dried fruit	<30
S20-033796	Year 1	Organic Cacao Nibs	Naturya	Roasted Cocoa Beans	264
S20-033797	Year 1	Raw Cacao Nibs	Creative Nature	Roasted Cocoa Beans	<30
S20-033798	Year 1	Natural Cacao Nibs	Food Thoughts	Roasted Cocoa Beans	364
S21-029480	Year 2	Cacao Nibs	Food Thoughts	Roasted cocoa beans	170
S21-029840	Year 2	Organic Cacao nibs	Naturya	Roasted cocoa beans	274
S21-031868	Year 2	Organic Raw Cacao Nibs	Morrisons	Roasted cocoa beans	68.8

\*n=3

**Table 20. Acrylamide results for Other products – Olives and confectionary, Year 1 and Year 2, results in µg/kg, corrected for recover**

Laboratory sample code	Sampling Year	Product description	Brand name	Group Descriptor	Acrylamide Result (µg/kg)
S20-033737	Year 1	Black Pitted Olives in Brine	Cypressa	Olives In brine	281
S20-033738	Year 1	Green Pitted Olives	Crespo	Olives In brine	<30
S20-033739	Year 1	Green Pitted Olives in Brine	Aldi	Olives In brine	<30
S21-029839	Year 2	Pitted Green Olives	Crespo	Olives in brine	<30
S21-029924	Year 2	Black pitted olives in brine*	Cypressa	Olives in brine	490*
S21-030365	Year 2	Pitted Olives	Odysea	Olives in brine	<30
S20-033799	Year 1	Clotted Cream Fudge	Bristows	Confectionary	<30
S20-033800	Year 1	Chewy Nougat	Barratt	Confectionary	<30
S21-030361	Year 2	Soft Nougat	Barratt	Confectionary	<30
S20-033801	Year 1	Fabulous Vanilla Fudge	Thorntons	Confectionary	<30
S20-033802	Year 1	Toffee	Tesco	Confectionary	<30
S21-031547	Year 2	Original Special Toffee Bag	Thorntons	Confectionary	<30

(\* n=3)



**Table 21. Furan results for potato snacks ( $\mu\text{g}/\text{kg}$ ), Year 1 and Year 2, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033854	Year 1	Sea Salted Crinkle Cut Crisps	Seabrook	11	8	<5	38	<5	-	<5	-	-
S20-033855	Year 1	Pringles Original	Pringles	17	<5	<5	20	<5	-	<5	-	-
S20-033722	Year 1	French Fries	Walkers	23	12	<5	147	<5	-	<5	-	-
S20-033856	Year 1	Hula Hoops Original	KP	36	10	5	40	<5	-	<5	-	-
S20-033857	Year 1	Popped Potato Chips Sea Salt	Pop Chips	77	10	<5	32	<5	-	<5	-	-
S21-029603	Year 2	Salted Flavour Crisps	Asda	9.1	7.0	<5	11.7	<5	<5	<5	<25	72.2
S21-029919	Year 2	French Fries	Walkers	21.7	11.1	<5	94.0	<5	<5	<5	<25	88.8
S21-030123	Year 2	Pringles Original	Pringles	18.2	<5	<5	8.3	<5	<5	<5	<25	<25.0
S21-030629	Year 2	Hula Hoops Original	KP	38.2	14.7	9.2	24.1	<5	<5	<5	<25	55.9
S21-031864	Year 2	Potato Chips Sea Salt	Pop Chips	55.0	6.6	<5	20.1	<5	<5	<5	<25	<25

No results as no labelled internal standard was available at the time of analysis

**Table 22. Furan results of other breakfast cereals ( $\mu\text{g}/\text{kg}$ ), Year 1 and Year 2, corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033826	Year 1	Cornflakes	Kellogg's	55	19	<5	<5	<5	-	<5	-	-
S20-033827	Year 1	Weetabix	Weetabix	21	15	<5	<5	<5	-	<5	-	-
S20-033828	Year 1	Cheerios	Nestle	35	17	5	14	<5	-	<5	-	-
S21-029925	Year 2	Corn Flakes	Kellogg's	25.2	8.9	<5	<5	<5	<5	<5	<25	<25
S21-030364	Year 2	Multigrain Cheerios	Cheerios	17.4	8.0	<5	<5	<5	<5	<5	<25	<25
S21-030722	Year 2	Weetabix	Weetabix	16.5	16.1	<5	<5	<5	<5	<5	<25	<25

**Table 23. Furan results of Other Fine Bakery Wares (excluding cakes and pastry), other - Crackers, biscuits etc., Year 1 and Year 2, ( $\mu\text{g}/\text{kg}$ ) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033829	Year 1	Cream Crackers	Jacob's	57	59	<5	7	<5		<5		
S20-033830	Year 1	Orkney Thick Oatcakes	Stockan's	5	29	36	<5	<5		<5		
S20-033831	Year 1	Gluten Free Wholegrain Crackers	Nairns	25	6	<5	<5	<5		<5		
S20-033832	Year 1	Dark Rye Crunchy Rye Breads	Ryvita	158	116	21	36	5		<5		
S20-033833	Year 1	Deluxe Scottish Shortbread	Lidl	<5	<5	<5	<5	<5		<5		
S21-029601	Year 2	Cream Crackers	Rivercote	26.5	19.3	<5	<5	<5	<5	<5	<25	<25
S21-030300	Year 2	Shortbread Fingers	Morrisons	5.1	<5	<5	<5	<5	<5	<5	<25	<25
S21-030366	Year 2	Thick Oatcakes	Stockan's	<5	10.0	<5	<5	<5	<5	<5	<25	<25
S21-030605	Year 2	Rye breads	Ryvita	121	82.3	12.6	26.4	<5	<5	<5	<25	135
S21-030627	Year 2	Rye Crispbread with Sesame Seeds	Rivercote	62.9	40.4	7.9	22.7	<5	<5	<5	<25	171

**Table 24. Furan Results of Instant Coffee, as sold and as consumed, Year 1 and Year 2 (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033834	Year 1	Decaff Coffee (instant) - as sold	Kenco	673	1936	84	<20	113	-	<5*	-	-
S20-033834	Year 1	Decaff Coffee (instant) - as consumed	Kenco	<5	7	<5	<5	<5	-	<5	-	-
S20-033838	Year 1	Origins Alta Rica Coffee (instant) – as sold	Nescafe Gold	691	3837	145	23	253	-	<20	-	-
S20-033838	Year 1	Origins Alta Rica Coffee (instant) – as consumed	Nescafe Gold	<5	13	<5	<5	<5	-	<5	-	-
S20-033840	Year 1	Instant Coffee – as sold	Aldi Alcafe	74	231	<20	<20	22	-	<5*	-	-
S20-033840	Year 1	Instant Coffee – as consumed	Aldi Alcafe	<5	<5	<5	<5	<5	-	<5	-	-
S20-033843	Year 1	Pure Gold Instant Coffee – as sold	Douwe Egberts	495	2116	102	<20	130	-	<20*	-	-
S20-033843	Year 1	Pure Gold Instant Coffee – as consumed	Douwe Egberts	<5	11	<5	<5	<5	-	<5	-	-
S21-029483	Year 2	Decaff Coffee (Instant) -as sold	Kenco	435	1522	66	<20	158	<20	<20	<25	<25
S21-029483	Year 2	Decaff Coffee (Instant) -as consumed	Kenco	4.1	11.0	<2.5	<2.5	<2.5	<2.5	<2.5	<25	<25
S21-029838	Year 2	Roast Instant Coffee -as sold	Aldi	41	199	<20	<20	26	<20	<20	<25	<25
S21-029838	Year 2	Roast Instant Coffee -as consumed	Aldi	<2.5	3.7	<2.5	<2.5	<2.5	<2.5	<2.5	<25	<25

**Table 25. Furan Results of Ground Coffee, as sold and as consumed, Year 1 (µg/kg) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033835	Machu Picchu Ground Coffee - as sold	Café Direct	2120	7666	462	149	717	-	<20	-	-
S20-033835	Machu Picchu Ground Coffee - as consumed	Café Direct	29	84	5	<5	7	-	<5	-	-
S20-033836	Classic Roast Ground Coffee - as sold	Illy	4477	14900	736	289	1687	-	<20	-	-
S20-033836	Classic Roast Ground Coffee – as consumed	Illy	61	189	8	<5	10	-	<5	-	-
S20-033837	Americano Organic Ground Coffee – as sold	Percol	5076	13100	713	305	1741	-	<20	-	-
S20-033837	Americano Organic Ground Coffee - as consumed	Percol	63	194	8	<5	10	-	<5	-	-
S20-033839	Rich Italian Ground Coffee – as sold	Taylors	4907	20920	825	307	1827	-	<20	-	-
S20-033839	Rich Italian Ground Coffee – as consumed	Taylors	75	255	10	<5	11	-	<5	-	-
S20-033841	Qualita Rossa (Ground coffee) – as sold	Lavazza	2247	10561	604	222	1074	-	<20	-	-
S20-033841	Qualita Rossa (Ground coffee) – as consumed	Lavazza	37	118	6	<5	8	-	<5	-	-
S20-033842	Mocha Italia Signature Blend (Ground – as sold)	Costa Coffee	2306	9091	461	150	796	-	<20	-	-
S20-033842	Mocha Italia Signature Blend (Ground) - as consumed	Costa Coffee	37	108	<5	<5	7	-	<5	-	-

**Table 26. Furan Results of Ground Coffee, as sold and as consumed, Year 2 (µg/kg) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S21-029832	Ground Coffee -as sold	Lavazza	2132	8893	448	162	1334	132	<20	<25	284#
S21-029832	Ground Coffee -as consumed	Lavazza	18.7	58.1	3.4	<2.5	6.7	<2.5	<2.5	<25	<25
S21-030299	Ground Coffee -as sold	Café Direct	3243	11866	598	140	1176	76	<20	<25	99#
S21-030299	Ground Coffee -as consumed	Café Direct	29.7	80.4	4.6	<2.5	4.6	<2.5	<2.5	<25	<25
S21-030437	Roast Coffee -as sold	Costa	2728	11627	399	143	1408	94	<20	<25	162#
S21-030437	Roast Coffee -as consumed	Costa	29.5	96.3	4.3	<2.5	10.5	<2.5	<2.5	<25	<25

(# levels not confirmed by qualifier ion)

**Table 27. Furan Results of Baby food, Year 1 ready meals, pouches as purchased and as consumed etc (µg/kg) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	Propyl
S20-033858	Chicken & Sweet Potato Curry	For Aisha	As purchased	26	6	15	12	<5	<5
S20-033858	Chicken & Sweet Potato Curry	For Aisha	Microwave	18	<5	9	6	<5	<5
S20-033858	Chicken & Sweet Potato Curry	For Aisha	Hob	14	<5	7	5	<5	<5
S20-033859	Tomato & Courgette Pasta	Cow & Gate	As purchased	33	13	5	259	<5	<5
S20-033859	Tomato & Courgette Pasta	Cow & Gate	Microwave	10	<5	<5	30	<5	<5
S20-033859	Tomato & Courgette Pasta	Cow & Gate	Water	13	<5	<5	32	<5	<5
S20-033860	Cottage Pie with Veggie Mash	Kiddylicious	As purchased	25	5	<5	232	<5	<5
S20-033860	Cottage Pie with Veggie Mash	Kiddylicious	Microwave	31	<5	<5	58	<5	<5
S20-033861	Veggie Lasagne	Ella's Kitchen	As purchased	35	14	19	179	<5	<5
S20-033861	Veggie Lasagne	Ella's Kitchen	Water	20	5	7	22	<5	<5
S20-033861	Veggie Lasagne	Ella's Kitchen	Hob	16	<5	6	23	<5	<5

**Table 27. contd. Furan Results of Baby food, Year 1 ready meals, pouches as purchased and as consumed ( $\mu\text{g}/\text{kg}$ ) corrected for recovery**

Laboratory sample code	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	Propyl
S20-033862	Chicken & Vegetable Casserole	Organic Mamia Aldi	As purchased	19	<5	<5	13	<5	<5
S20-033862	Chicken & Vegetable Casserole	Organic Mamia Aldi	Water	14	<5	<5	23	<5	<5
S20-033862	Chicken & Vegetable Casserole	Organic Mamia Aldi	Microwave	14	<5	<5	17	<5	<5
S20-033863	By Nature Spaghetti Bolognese	Heinz	As purchased	22	9	5	8	<5	<5
S20-033863	By Nature Spaghetti Bolognese	Heinz	Water	20	<5	<5	70	<5	10
S20-033863	By Nature Spaghetti Bolognese	Heinz	Microwave	21	<5	5	<5	<5	<5
S20-033864	Organic Pasta Bolognese	Lupilu	As purchased	27	6	8	16	<5	<5
S20-033864	Organic Pasta Bolognese	Lupilu	Microwave	19	<5	<5	13	<5	<5



**Table 27. contd. Furan Results of Baby food, Year 1 ready meals, pouches as purchased and as consumed ( $\mu\text{g}/\text{kg}$ ) corrected for recovery**

Laboratory sample code	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	Propyl
S20-033865	Organic Carrot, Sweet Potato & Butternut Squash	Piccolo	As purchased	26	8	5	22	<5	<5
S20-033865	Organic Carrot, Sweet Potato & Butternut Squash	Piccolo	Water	22	<5	<5	47	<5	<5
S20-033866	Organic Sweet Squash & Chicken	Hipp	As purchased	22	6	<5	67	<5	<5
S20-033866	Organic Sweet Squash & Chicken	Hipp	Water	19	<5	<5	48	<5	<5
S20-033866	Organic Sweet Squash & Chicken	Hipp	Microwave	21	<5	<5	11	<5	<5
S20-033867	Butternut Squash, Carrot & Broccoli	Babease	As purchased	42	5	<5	60	<5	<5
S20-033867	Butternut Squash, Carrot & Broccoli	Babease	Water	42	5	<5	60	<5	<5

**Table 28. Furan Results of Baby food, Year 2 ready meals, pouches as consumed (µg/kg) corrected for recovery**

Laboratory sample code	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S21-029835	Spaghetti Bolognese	Asda little angels	56.1	11.4	<5	27.5	<5	<5	<5	<5	28.4
S21-029836	Chicken casserole with rice	Mamia Organic	44.8	7.6	7.1	8.1	<5	<5	<5	<5	<25
S21-029922	Chicken & Sweet Potato Curry	For Aisha	160	18.5	17.1	16.2	<5	<5	<5	<5	34.7
S21-030436	Vegetable & Lentil Bake	Ella's Kitchen	72.9	12.9	10.2	13.4	<5	<5	<5	<5	<25
S21-030607	Sunday Chicken Dinner	Heinz	16.9*	<5	<5	9.0	<5	<5	<5	<5	<25
S21-030634	Organic Vegetables with Rice and Chicken	HiPP Organic	30.8	6.9	<5	9.4	<5	<5	<5	<5	30.0
S21-030717	Cottage Pie	Ella's Kitchen	25.4	5.9	7.5	6.6	<5	<5	<5	<5	<25
S21-030724	Sweet Potato Chicken and Veggies	Heinz	147	16.5	16.5	56.3	<5	7.2	<5	<5	107
S21-030725	Organic Butternut Squash Mac & Cheese	Piccolo	55.3	12.0	6.2	29.7	<5	<5	<5	<5	<25
S21-030726	Vegetable Risotto	Babease	72.2*	<5	<5	7.9	n/r	n/r	n/r	n/r	n/r

(\* n=2, furan only), (n/r – no results due to analysis issues)

**Table 29. Furan Results of Cereal based food for infants and young children, Year 2, (µg/kg) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
<b>S21-029482</b>	<b>Rusks</b>	<b>Farleys</b>	<b>As sold</b>	<b>&lt;5</b>	<b>&lt;5</b>	<b>&lt;5</b>	<b>&lt;5</b>	<b>&lt;5</b>	<b>&lt;5</b>	<b>&lt;5</b>	<b>&lt;25</b>	<b>43.8</b>
S21-029486	Apple and Banana Muesli	HiPP Organic	As sold	5.2	<5	<5	<5	<5	<5	<5	<25	32.1
S21-029486	Apple and Banana Muesli	HiPP Organic	As on packet	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<25	<25
S21-029611	Baby rice	Cow & Gate	As sold	<5	<5	<5	<5	<5	<5	<5	<25	<25
S21-029611	Baby rice	Cow & Gate	As on packet	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<25	<25
S21-029923	Biscotti Banana	Kiddylicious	As sold	<5	<5	<5	<5	<5	<5	<5	<25	<25
S21-030124	Creamed porridge (ready made)	Heinz	As sold	90.5	13.9	<2.5	8.6	<2.5	<2.5	<2.5	<25	29.7
S21-030124	Creamed porridge (ready made)*	Heinz	As on packet	90.9	16.3	<5	9.8	<5	<5	<5	<25	<25
S21-030606	Creamy Porridge	HIPP Organic	As sold	<5	<5	<5	<5	<5	<5	<5	<25	29.9
S21-030606	Creamy Porridge	HIPP Organic	As on packet	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<25	<25
S21-030714	Vanilla and banana biscuits	Ella's Kitchen	As sold	<5	<5	<5	<5	<5	<5	<5	<25	26.8

Laboratory sample code	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S21-030723	Teething Biscuits	Bickiepegs	As sold	12.2	<5	<5	<5	<5	<5	<5	<25	<25

(\* n=2)

**Table 29. contd. Furan Results of Cereal based food for infants and young children, Year 2, ( $\mu\text{g}/\text{kg}$ ) corrected for recovery.**

Laboratory sample code	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S21-031094	Organic Baby Rice	Aptamil	As sold	<5	<5	<5	<5	<5	<5	<5	<25	<25
S21-031094	Organic Baby Rice	Aptamil	As on packet	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<25	<25
S21-031495	Organic Apple Biscotti	Mamia Organic	As sold	<5	7.5	<5	<5	<5	<5	<5	<25	<25

**Table 30. Furan Results of others, vegetable crisps, Year 1 and Year 2, ( $\mu\text{g}/\text{kg}$ ) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033849	Year 1	Hummus Chips	Eat Real	5	5	<5	17	<5		<5		
S21-031546	Year 2	Hummus chips	Eat Real	6.0	6.0	<5	11.5	<5	<5	<5	<25	49.1#
S20-033853	Year 1	Lentil Bites	The Foodie Market	7	<5	<5	29	<5		<5		
S21-030298	Year 2	Lentil Chips	The Daily Crave	23.2	12.2	6.4	91.3	<5	<5	<5	<25	102
S21-030435	Year 2	Sea Salt Lentil chips	Propper	9.7	5.9	6.6	12.1	<5	<5	<5	<25	186
S21-029608	Year 2	Shitake Mushroom Crisps	DJ&A	8.9	18.6	<5	5.9	7.3	<5	<5	<25	56.7
S20-033850	Year 1	Veg Crisps - Beetroot	Tyrells	20	21	<5	9	<5		<5		
S20-033850	Year 1	Veg Crisps - Carrot	Tyrells	11	17	<5	7	<5		<5		
S20-033850	Year 1	Veg Crisps - Parsnip	Tyrells	5	7	<5	10	<5		<5		
S21-030297	Year 2	Veg crisps - carrot	Tyrrells	17.1	30.6	7.3	10.6	<5	<5	6.2	<25	430#
S21-030297	Year 2	Veg crisps parsnip	Tyrrells	7.2	9.3	<5	10.0	<5	<5	5.0	<25	289#
S21-030297	Year 2	Veg crisps -beetroot	Tyrrells	10.7	12.7	<5	7.8	<5	<5	5.3	<25	459#

(# Results indicative as either out of cal range/ion not confirmed)

**Table 30. contd. Furan Results of others, vegetable crisps, Year 1 and Year 2, ( $\mu\text{g}/\text{kg}$ ), corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033851	Year 1	Root Vegetable & Sea Salt Crisps - Beetroot	Aldi	34	42	5	10	<5		<5		
S20-033851	Year 1	Root Vegetable & Sea Salt Crisps - Parsnip	Aldi	6	10	<5	24	<5		<5		
S20-033851	Year 1	Root Vegetable & Sea Salt Crisps - Sweet Potato	Aldi	6	10	7	13	<5		<5		
S21-031496	Year 2	Vegetable Crisps with Sea Salt - carrot	Aldi	11.7	19.5	6.1	7.4	<5	<5	<5	<25	344#
S21-031496	Year 2	Vegetable Crisps with Sea Salt - parsnip	Aldi	8.9	12.0	<5	8.0	<5	<5	<5	<25	193
S21-031496	Year 2	Vegetable Crisps with Sea Salt - beetroot	Aldi	18.6	21.6	<5	6.9	<5	<5	<5	<25	317#
S20-033852	Year 1	Lightly Salted Veg Chips - Beetroot	Kettle	44	65	5	13	8		<5		
S20-033852	Year 1	Kettle Lightly Salted Veg Chips- Parsnip	Kettle	12	21	7	22	<5		<5		
S20-033852	Year 1	Kettle Lightly Salted Veg Chips -Sweet Potato	Kettle	12	22	10	24	<5		<5		
S21-030719	Year 2	Veg Chips Lightly Salted - carrot	Kettle	15.5	22.8	8.7	20.2	<5	<5	5.5	<25	696#
S21-030719	Year 2	Veg Chips Lightly Salted - parsnip	Kettle	18.6	24.1	8.2	26.1	<5	<5	6.7	<25	627#
S21-030719	Year 2	Veg Chips Lightly Salted - beetroot	Kettle	29.9	34.4	6.8	10.3	7.1	<5	<5	<25	391#

(# Results indicative as either out of cal range/ion not confirmed)

**Table 31. Furan Results of others – ready to eat soup, Year 1 and Year 2 – as consumed (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-033878	Year 1	Cream of Tomato Soup	Heinz	As bought	22	14	9	6*	<5	-	<5	-	-
S20-033878	Year 1	Cream of Tomato Soup	Heinz	microwave	14	9	5	<5	<5	-	<5	-	-
S20-033878	Year 1	Cream of Tomato Soup	Heinz	hob	9	5	<5	<5	<5	-	<5	-	-
S20-033879	Year 1	Spicy Parsnip Soup	Baxters	As bought	50	<5	<5	18*	<5	-	<5	-	-
S20-033879	Year 1	Spicy Parsnip Soup	Baxters	microwave	37	<5	<5	19*	<5	-	<5	-	-
S20-033879	Year 1	Spicy Parsnip Soup	Baxters	hob	28	<5	<5	26*	<5	-	<5	-	-
S21-029484	Year 2	Broccoli & Stilton Soup	Crosse & Blackwell	As bought	18.6#	<5	<5	<5	<5	<5	<5	<25	<25
S21-029605	Year 2	Carrot and Coriander Soup	Heinz	As bought	20.4	6.3	5.3	<5	<5	<5	<5	<25	<25
S21-029834	Year 2	Condensed Soup Cream of Mushroom	Batchelors	As bought	20.4	6.7	<5	<5	<5	<5	<5	<25	<25
S21-030633	Year 2	Cream of Chicken Soup	Newgate	As bought	20.9	<5	<5	7.0	<5	<5	<5	<25	<25

#n=2.

\*Results for ethyl furan indicative as recovery values were outside acceptable range.

**Table 32. Furan Results of others – fruit juices (µg/kg) corrected for recovery.**

Laboratory sample code	Sampling Year	Product description	Brand name	Preparation	Furan	2MF	3MF	Ethyl	2,5DMF	2,3DMF	Propyl	Butyl	Pentyl
S20-049834	Year 1	Cloudy Apple Juice	Copella	As bought	<5	<5	<5	<5	<5	-	<5	-	-
S20-033881	Year 1	Rooting For You Cold Pressed Juice	Lidl Naturis	As bought	<5	<5	<5	<5	<5	-	<5	-	-
S20-033882	Year 1	Apple & Blackcurrant Squash	Robinsons	As bought	<5	5	<5	<5	<5	-	<5	-	-
S20-033882	Year 1	Apple & Blackcurrant Squash	Robinsons	As consumed	<5	<5	<5	<5	<5	-	<5	-	-
S20-033883	Year 1	Smooth Orange Juice	The Juice Company	As bought	<5	<5	<5	<5	<5	-	<5	-	-
S20-049835	Year 1	Pressed Apple Juice	Tropicana	As bought	<5	<5	<5	<5	<5	-	<5	-	-
S21-029613	Year 2	Orange Juice with Juicy Bits	The Juice Company	As bought	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
S21-030608	Year 2	Apple & Elderflower juice	Copella	As bought	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
S21-031595	Year 2	Tropical Juice	Innocent	As bought	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5



**Table 33. Results of Fapas® PT rounds for Acrylamide undertaken during Year 1 and Year 2.**

<b>Fapas® PT rounds</b>	<b>Z-score</b>
Fapas® Round and matrix	Acrylamide
30101 Veg crisps	1.6
30104 Biscuit	0.9
30105 French fries	1.0
30107 Coffee	1.7
30109 Potato crisps	0.2
30115 French Fries	0.8
30117 Coffee (Instant)	-0.8
30118 Crispbread	0.1

**Table 34. Results of Fapas® PT round for Furans undertaken during Year 1**

<b>Fapas® Round and matrix</b>	<b>Furan (Z-score)</b>	<b>2-Methylfuran (Z-score)</b>	<b>3-Methylfuran (Z-score)</b>	<b>2,5-Dimethylfuran (Z-score)</b>	<b>2-Ethylfuran (Z-score)</b>
30108 Coffee	-0.3	0.0	0.8	0.6	0.8 <i>(info only)</i>

No suitable PT rounds were available for furans during Year 2.

Performance for furans assessed against LGC standard and Fapas® reference material—see Table 34 and Table 35.

**Table 35. Quality control data for acrylamide analysis - Year 1.**

<b>Fera Analysis Batch No.</b>	<b>Average Recovery (%)</b>	<b>n</b>	<b>IHR</b>	<b>Z-Score*</b>
PC20-03343	100	4	3084	0.5
PC20-03447	99	2	3084	0.44
PC20-03540	101	2	3084	0.49
PC20-03657	96	3	3084	0.32
PC20-03687	103	2	3084	0.68
PC20-03718	105	5	3091	0.4
PC20-03784	103	2	3099	0.36
PC20-03851	96	1	3095	0.1
PC20-03967	94	1	3095	0.23
PC20-04035	92	3	3091	0.08
PC20-04086	90	3	n/a	n/a
PC20-04162	104	2	n/a	n/a
PC20-04188	102	3	3095	0.61
PC20-04236	94	2	3091	0

\*Z-Score calculated from analytical result compared to assigned value for the In-House Reference material. A Z-score between -2 and +2 is acceptable.

**Table 36. Quality control data for acrylamide analysis - Year 2.**

<b>Fera Analysis Batch No.</b>	<b>Average Recovery (%)</b>	<b>n</b>	<b>IHR</b>	<b>Z-Score*</b>
PC21-03322	84	2	3085	-0.34
PC21-03436	99	2	3092	0.64
PC21-03570	95	1	3085	-0.62
PC21-03829	114	2	3092	1.65
PC21-03990	108	2	3092	0.87
PC21-04015	101	2	3085	-0.11
PC21-04177	96	2	3092	-0.15
PC21-04260	116	2	3092	0.17
PC21-04313	98	2	3092	-0.03
PC21-04707	95	2	3085	-0.09
PC21-04836	99	2	30104	1.11
PC21-04878	101	1	30104	1.21

\*Z-Score calculated from analytical result compared to assigned value for the In-House Reference material. A Z-score between -2 and +2 is acceptable.

**Table 37. Recovery data for Furan analysis – Year 1.**

<b>Fera Analysis Batch No.</b>	<b>Matrix</b>	<b>spike level ug/kg</b>	<b>Recovery (%) Furan</b>	<b>Recovery (%) 2MF</b>	<b>Recovery (%) 3MF</b>	<b>Recovery (%) Ethyl</b>	<b>Recovery (%) 2,5DMF</b>	<b>Recovery (%) Propyl</b>
PC20 04846	Coffee	100	94	71	85	84	83	55
PC20 04888	Coffee	25	94	85	89	100	94	95
PC20 04888	Coffee as consumed	100	94	85	89	100	94	95
PC20 04894	Coffee Substitute	100	117	127	89	98	102	76
PC20 04895	Coffee Sub as consumed	25	96	95	96	111	103	112
PC20 04945	Coffee	100	96	94	88	101	99	77
PC20-04955	Coffee as consumed	25	90	80	102	92	79	101
PC20-04971	Wet Baby food	25	66	107	68	164	88	82
PC20-05012	Dry baby cereal - recons.	25	108	88	102	247	77	205
PC20-05014	Dry baby cereal	25	66	78	87	97	77	84
PC20-05052	Soup etc.	25	87	75	71	626	94	335
PC20-05052	Drinks	25	108	101	103	150	95	113
PC20-05056	Dry baby snacks	25	71	68	88	159	50	65
PC20-05058	Veg crisps	25	81	75	69	79	70	111
PC20-05247	Wet baby food - as consumed	25	75	101	42	129	91	72

**Table 38. Recovery data for Furan analysis – Year 2 - Recovery (%), n= 1-2**

<b>Fera Analysis Batch No.</b>	<b>Matrix</b>	<b>Spike level</b>	<b>Furan</b>	<b>2MF</b>	<b>3MF</b>	<b>Ethyl</b>	<b>2,5DMF</b>	<b>2,3DMF</b>	<b>Propyl</b>	<b>Butyl</b>	<b>Pentyl</b>
PC21-00168	Cereal (dry infant)	25	89	94	84	93	87	100	67	41	71
PC21-00169	Cereal (wet infant)	5	82	87	89	101	92	104	47	38	90
PC21-05501	Coffee (dry)	500	75	99	79	92	106	74	58	33	94
PC21-05502	Coffee (brew)	50	80	90	95	94	94	25	95	90	91
PC21 05540	Cereal (dry)	25	110	107	92	88	89	105	55	32	147
PC21 05582	Crisps	25	62	86	92	82	95	116	61	30	15
PC21-05774	Juice (orange)	5	100	120	104	110	93	86	102	66	116
PC22-00359	Wet food (savory)	25	104	99	105	97	105	109	73	53	54

**Table 39. Summary of Furans QC – Year 2, accuracy and precision LGC std check. – LGC standard recovery %**

<b>Batch ID</b>	<b>Furan</b>	<b>2MF</b>	<b>3MF</b>	<b>Ethyl</b>	<b>2,5DMF</b>	<b>Butyl</b>	<b>Pentyl</b>
PC21-00168	116	94	90	99	111	103	89
PC21-00169	122	106	103	112	140	104	85
PC21-05501	108	93	95	109	113	113	106
PC21-05502	109	99	99	108	114	101	87
PC21-05540	92	95	88	99	124	102	84
PC21-05582	117	103	99	111	119	115	90
PC22-00359	77	71	74	83	101	76	75
Average	106	95	93	103	117	102	88
RSD %	15	12	11	10	11	13	11

**Table 40. FAPAS reference material furan check, Year 2 (µg/kg)**

<b>Batch ID</b>		<b>Furan</b>	<b>2MF</b>	<b>3MF</b>
FAPAS 3088	Upper	3560	12000	705
FAPAS 3088	Lower	2000	7560	337
PC21-05501	N=1	2753	7866	337

## Annex 2: References

1. Retained Commission Regulation (EU) 2017/2158 of 20 November 2017 [establishing mitigation measures and benchmark levels for the reduction of the presence of acrylamide in food](#)
2. Commission Recommendation (EU) 2019/1888 of 7 November 2019 [on the monitoring of the presence of acrylamide in certain foods](#)
3. Commission Recommendation of 28 March 2007 on [the monitoring of the presence of furan in foodstuffs](#), 2007/196/EC.
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5. Commission Recommendation of 3 May 2007 on [the monitoring of acrylamide levels in food \(notified under document number C \(2007\) 1873\)](#).
6. Report FR\_002164 FSA Survey on Acrylamide and Furan – Year 1, 2021
7. Report FR\_002164 FSA Survey on Acrylamide and Furan – Year 2, 2022
8. [Food Standards Agency Guidelines for Undertaking Surveys](#)
9. CEN/TS 17083:2017 Foodstuffs - [Determination of acrylamide in food and coffee by gas chromatography-mass spectrometry \(GC-MS\)](#).
10. Montañó, A., Casado, F.J., and Carle, R. 2016, Chapter 12 - Acrylamide in Table Olives. Acrylamide in Food, Analysis, Content and Potential Health Effects, Pages 229-251. Acrylamide in Food <https://doi.org/10.1016/B978-0-12-802832-2.00012-7>
11. Retained Regulation (EU) No 609/2013 of the European Parliament and of the Council of 12 June 2013 on food intended for infants and young children, food for special medical purposes, and total diet replacement for weight control and repealing Council Directive 92/52/EEC, Commission Directives 96/8/EC, 1999/21/EC, 2006/125/EC and 2006/141/EC, [Directive 2009/39/EC of the European Parliament and of the Council and Commission Regulations \(EC\) No 41/2009 and \(EC\) No 953/2009](#)



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